In This Issue—*Cylinder Regrinding and Kindred Problems*



# MOTOR AGE

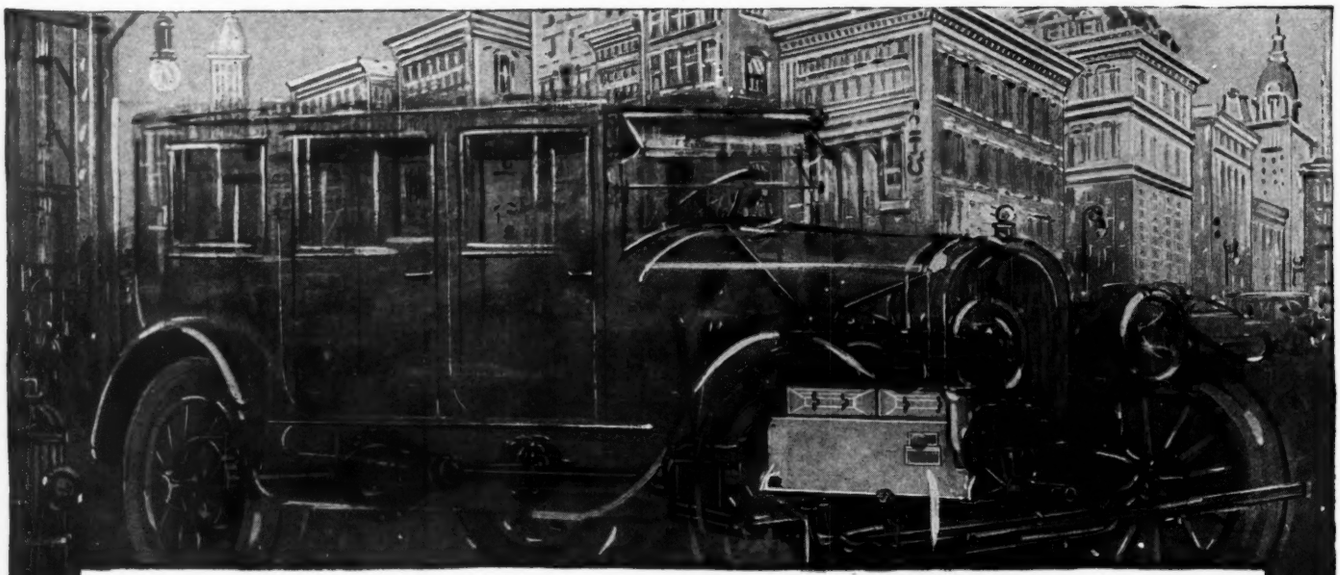
Vol. XLI
Number 20

PUBLISHED WEEKLY AT THE MALLERS BUILDING
CHICAGO, MAY 18, 1922

Thirty-five Cents a Copy
Three Dollars a Year



Entered as second class matter Sept. 19, 1899, at the post office at Chicago, Ill., under Act of Mar. 3, 1879



# The ever increasing demand for SPECIALIZED vehicles reflects public preference for *proven* units

In purchasing a car or truck, the buyer of today focuses his attention on essentials. The vital parts upon which depend *performance* must be *proven* units—such units as are used exclusively in the building of high-grade SPECIALIZED vehicles.

Experienced users know the value of owning a vehicle in which every major unit is the product of an organization of *specialists*—a vehicle that is guaranteed by the builder, backed by the SPECIALIZED unit manufacturers and protected by parts-distributing stations that dot the world.

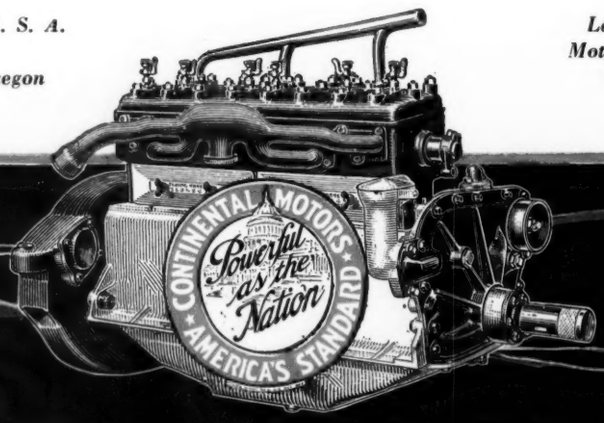
Car and truck dealers recognize in the increasing popularity of SPECIALIZED vehicles an opportunity to build a profitable business on the only foundation that is sound—the foundation of consumer confidence. And dealers' service organizations see in the system of parts-distributing stations the means for more efficient servicing, elimination of delays and reduction of overhead.

It is, therefore, to the advantage of dealers' service organizations to further the sale of SPECIALIZED vehicles—vehicles that embody such *proven* units as that foremost product of SPECIALIZATION—the motor that bears on its crankcase the Continental Red Seal.

## CONTINENTAL MOTORS CORPORATION

*Offices: Detroit, U. S. A.*
*Factories:*
*Detroit and Muskegon*

*Largest Exclusive Motor Manufacturers in the World*




# Continental Motors

# MOTOR AGE

Published Every Thursday by
THE CLASS JOURNAL COMPANY
MALLERS BUILDING
59 East Madison Street, CHICAGO

Vol. XLI Chicago, May 18, 1922 No. 20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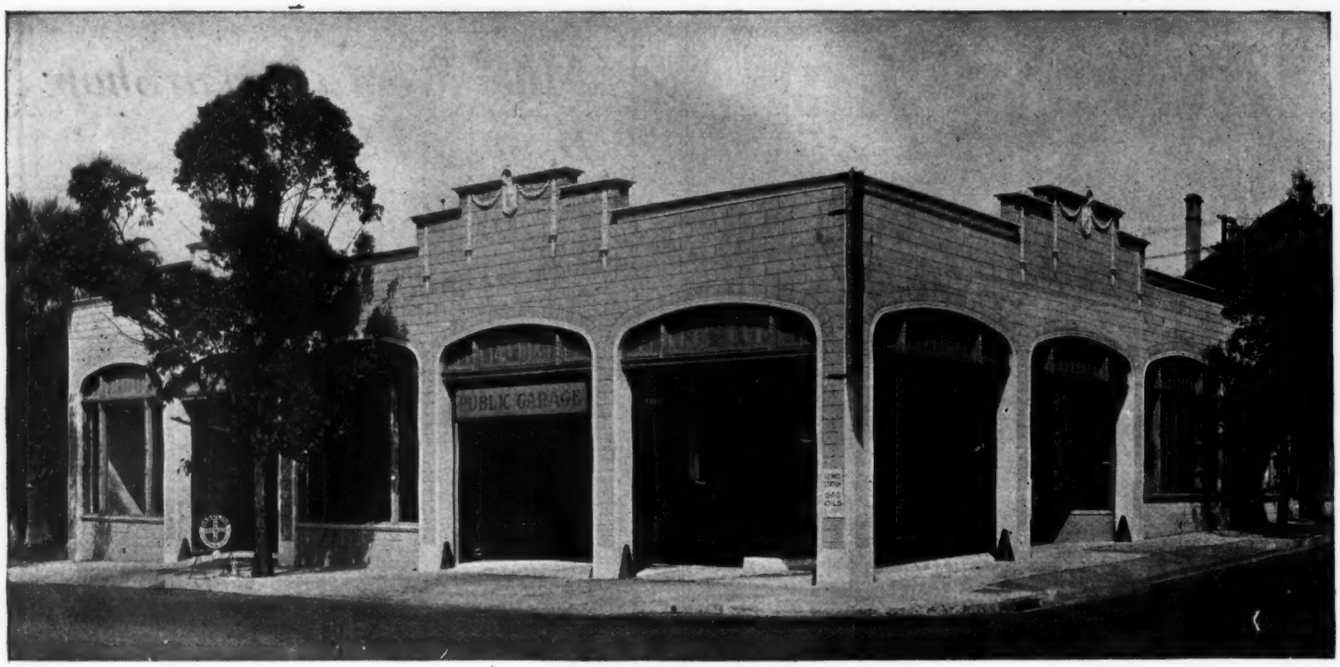
SUBSCRIPTION RATES

| | |
|---|---|
| United States, Mexico and U. S. Possessions | $ 3.00 per year |
| Canada | 5.00 per year |
| All Other Countries in Postal Union | 6.00 per year |
| Single Copies | 35 cents |

**Subscriptions accepted only from the Automotive Trade**

Entered as Second Class Matter Sept. 19, 1899, at the Post Office at Chicago, Ill., under Act of March 6, 1879.




Cream matt glazed Terra Cotta, trim and ornament

ALVARADO GARAGE
LOS ANGELES, CALIF.

RICHARD KING, Architect

# *The* DIFFERENCE *Trim Can Make*

IT'S surprising how a little trim can transform an otherwise plain-looking garage building into one of pleasing appearance and business-attracting value. And the additional expense is trifling—if you employ Terra Cotta.

Notice the Alvarado Garage, Los Angeles, pictured above. Although it is only faced with skin-construction stucco, this garage presents a most attractive appearance to the passing motorist—simply because it is trimmed with cream colored matt glazed Terra Cotta. This use of Terra Cotta makes the building a forceful, all-year-round advertisement for the Alvarado Garage and its service.

In addition to its beauty Terra Cotta possesses other features which make it peculiarly adapted to garages and service stations. Moderate in initial cost Terra Cotta's upkeep expense is practically negligible. It is proof against oil, greases and dirt. An occasional washing with soap and water keeps the surface bright and new. And Terra Cotta is weatherproof and fire-resistant.

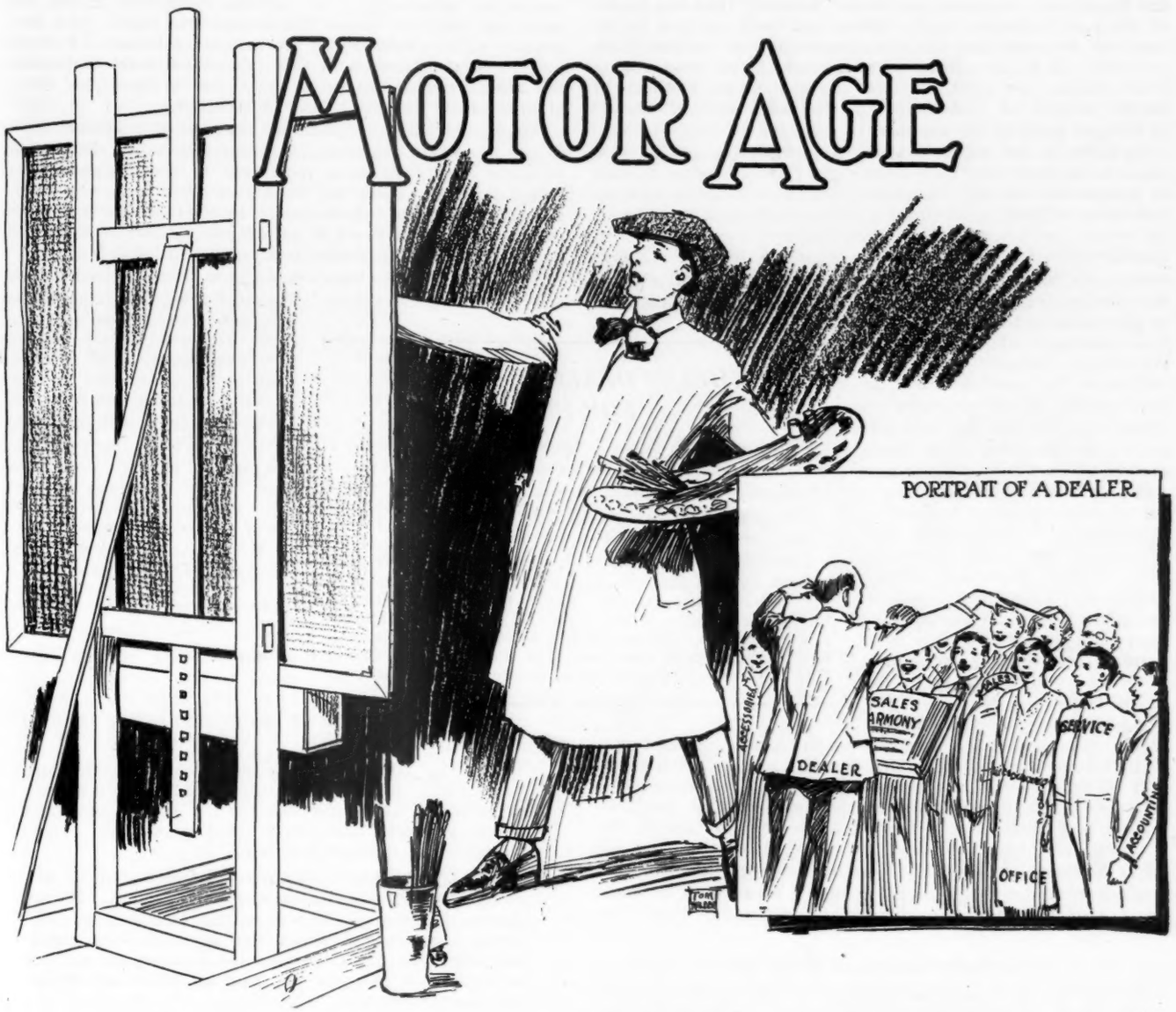
If you should be planning a new garage building, write and tell us about it. Whether you require just trim or facing material for the entire building, we can send you information which may save you time and money when you decide to build. Address **National Terra Cotta Society**, 19 West 44th St., New York, N. Y.

# TERRA COTTA

*Permanent* *Beautiful* *Profitable*

Vol. XLI, No. 20 CHICAGO, MAY 18, 1922 $3 Per Year

# MOTOR AGE




# *Future Automotive Dealer Pictured for Michigan Dealers*

## *Speakers Picture Him as a Man Who Will Co-ordinate His Staff Into a Harmonious Selling Group*

Detroit, May 10.

A COMPOSITE picture of the automobile dealer of the future was painted by the several speakers who appeared before the annual meeting of the Michigan Automotive Trade Association here. This average dealer of the days to come was shown to be the most advanced type of the present-day dealer—a man who knows his merchandise, knows why he selected this particular car, to whom he is going to sell and why. This man is contrasted with the man who today has collected a force of salesmen and is reaching out for profits.

Norval A. Hawkins, director of sales, advertising and service, on the advisory staff of the General Motors, talked on all the subjects included in his department, in an address occupying an hour and a half, but he laid special emphasis on the necessity of a selling spirit actively at work in every branch of a dealer organization. He declared that a sales manager should be competent not merely to direct a sales staff, but to teach selling of the dealer, his products and his service to every employe from president down to grease boy.

J. James MacGregor, president of the St. Louis Cadil-

lac Co., analyzed the dealer's sales dollar and showed the importance of correct buying, particularly of used cars.

Neal G. Adair, editor of Motor World, presented the dealer of the future as a business man better informed than the dealer of the past regarding public affairs and their relation to his business, and regarding the sales possibilities of his immediate territory. In a talk illustrated with charts he pictured, among other things, the most effective and economical methods of finding buyers as established by the experience of dealers in various parts of the country.

Upwards of 150 dealers out of a membership of 250 tore themselves away from their business at the peak selling period to attend the two-day convention, which included a banquet addressed by George M. Graham, vice president of the Chandler Motor Car Co., and E. V. Rickenbacker, vice president of the Rickenbacker Motor Car Co. Other speakers at the convention included Ray W. Sherman, merchandising director of the Automotive Equipment Assn., who showed the "Ask 'Em to Buy" film, and C. A. Vane, general manager of the National Automobile Dealers' Assn., who explained the qualifications for membership in the organization under its new plan and who discussed the ambition of the association to contribute toward putting the dealer of the future on a higher plane of doing business.

The Michigan association, only a year old, heard its officers report several important accomplishments in getting legislative co-operation with the trade. Plans were inaugurated to assure even more aggressive representation at the state capitol next year.

The chief business of the session, however, was the business of the members of the association--merchandising—and particularly effective along this line was the address of Hawkins.

In his opening remarks, the speaker emphasized some recent criticism of the automotive industry, asserting that more attention had been given to perfecting production than to distribution and that the time had now come to bring the latter up to the standard of the manufacturing. He expressed confidence in the future of the industry because "it is based on a universal and ever-increasing demand for fast and economical transportation."

### *Everybody Concerned With Sales*

Taking up the immediate problems of the dealer, he said:

"Inasmuch as sales concern everybody in a business, they should in turn, be everybody's concern. Therefore, it should be your aim that each employe shall be made to regard himself as a salesman, and instructed in his function and shown his opportunities as such so that he may be a good and not a bad salesman. There is not an employe of a concern represented here today who does not exert some influence on sales possibilities of the business.

"It is impossible to exaggerate the impetus that would be given to sales if there were coordinated, intelligent direction of the thoughts of all your employed men and women toward a common objective which would in turn be reflected directly and indirectly in greater sales for each and every one of your organizations.

"You should be taking steps to put these thoughts across to your employes right down to the last man.

"In order to accomplish this result, the whole organization must be permeated with the selling idea. That is, the principles of salesmanship must be used throughout the business, taking the place of arbitrary policy, and using objective methods, instead of subjective methods, to get things done.

### *Work for the Sales Department*

"It is generally admitted now that salesmanship is an art, governed by pretty well defined scientific rules. If all these rules were generally known and followed, the sales efficiency of business would be tremendously increased. Therefore, a second fundamental principle of sales policy should be the development of a sales department, under the direction of a competent salesmanager, to include everybody in the business and not just those individuals who come into direct contact with customers, as professional salesmen. It should be part of the function of this sales department to permeate the business with the sales spirit, and to open the eyes of all individuals to their sales opportunities.

"Beginning with the principle that every individual in the organization is a salesman, the next stage is the development of sales ability in each individual to the highest degree. There is some excuse for shop and office men who do not use sales methods because they do not consider themselves as salesmen. But there is no excuse for the lack of salesmanship so common among ordinary so-called salesmen.

"In the automobile business we have been inclined to boast about our progressiveness. Frequently we hear compliments regarding the automobile salesman. He is generally regarded as a superior type of salesman. I am proud to say that there are in the automobile industry some of the very finest salesmen in the world. But I am frank to admit that some of the very worst salesmen I have ever met bore the cards of automobile dealers. Between the two extremes there is an average that the industry has no especial reason to be proud of.

### *Experiences Along Automobile Row*

"Not so long ago an analyst made a trip along Automobile Row. His experiences were interesting and rather humiliating for a sales executive to hear.

(1) The salesman of the first dealer called upon was too busy shifting a car into place in the showroom to give any more attention than a nod to the supposed prospect. The caller stood around for a few minutes and then walked out.

(2) The salesman who greeted the visitor at the second dealer's showroom was very cordial. It appeared that the car he was selling had been an 'oil-pumper' in previous years, and about the first thing this salesman explained was the new model was no longer an 'oil pumper,' and that all its former faults had been taken out.

(3) The third salesman was of a noisy type. He started out by declaring that his car had the most powerful motor in the world and that it was a good car now because the management had been shaken up.

(4) The fourth salesman, at another dealer was very proud of the car he represented. This pride quickly developed into 'knocks' against competing cars that were casually mentioned by the prospect.

(5) The fifth salesman was a fast worker. He started in immediately to 'qualify' his prospect. Finding that the supposed buyer was not thinking of purchasing a car at once, the salesman lost all interest in him.

"Salesmen like these will never bring business back. They are going back where business used to be, in the 'jazz days'—when taking orders for automobiles was a game—not a business.

### *The Cost of Selling*

"How many here realize that our selling processes today are so inefficient that they amount to more in cost than all the process of production? Efficiency in automobile manufacture has been raised to a very high degree, and so far outstrips efficiency in distribution, that the costs of making versus marketing cars are altogether out of proportion. In order to bring business back, costs must be lowered so that

### *MICHIGAN DEALERS' OFFICERS FOR 1922*

President—M. L. Garlock, Lansing.

Vice President—W. K. Philip, Grand Rapids.

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the market may be widened. Up to now we have concentrated our efforts on reducing factory costs, and have neglected the greater costs of getting the goods turned into profits through efficient and economical selling.

"The most vital essential of business reform at the present time is economy.

"Greater economies are possible in our marketing.

"We must stop doing things that do not pay and stop putting up with salesmen that do not pay.

"We should be cutting out now the selling wastes, not chopping off our sales efficiency. The way to eliminate wastes is by knowing how to sell, and practicing that knowledge after we acquire it. We should be studying salesmanship service first and perfecting ourselves in that kind of selling. And remember that right salesmanship involves fundamental principles of business policy and organization, not just selling talk.

### *A Representative Building*

"What sort of an advertisement of maintenance is your place of business, for instance? Is your building adapted especially for your representation of your car? Have you an attractive showroom and a fully equipped maintenance shop? Do you keep a complete stock of parts and up-to-minute records to prevent the possibilities of failure in service anywhere? Are you doing effective publicity work to sell your maintenance functions?

"I have visited the places of business of a great many automobile dealers who were the worst kind of misrepresentatives of the manufacturers of the cars they dealt in. A place of that sort is a disgrace to the name of the car it displays. It is an insult to every man or woman who might come in with the idea of buying anything there. Clean people won't go into a dirty showroom to look at a clean automobile. They can't believe, either, that a car in that sort of place could be clean.

"In the showrooms of some of these misrepresentative dealers you can find nearly anything under God's heaven to distract a prospect from actually buying an automobile. The salesroom is not the place for displaying a lot of extra equipment and repair parts that would scare anybody out of a notion of buying, the minute he gets the suggestion of extras and expenses.

### *The Ideal Salesroom*

"The ideal automobile salesroom hasn't a single thing in it except the proper decorations and necessary furniture and the cars on the floor—plus clean, keen, attentive salesmen of service first who never let a prospect put his fingers on the front door knob without being right there on-the-spot to welcome him and help him. A would-be buyer never gets lost in that sort of a salesroom. Somebody keeps track of him and serves his needs every minute.

"Good business sense requires that the parts stockroom should be entirely separate from the salesroom, and the shop should not be visible from the place where the selling is to be done.

(*Mr. Hawkins remarks on maintenance are rather self-contained and present a rather novel viewpoint. They will be printed in an early issue of* MOTOR AGE.)

### *Now We Come to Maintenance*

"Generally speaking, maintenance in the automotive industry has been handled in a careless and inefficient manner. In the majority of cases, it has been looked upon as a necessary evil—a side issue, subordinate to the major activity of building and selling complete units. It has developed—or rather it has 'grown up' in a hit-or-miss sort of fashion and has never had a share of recognition and sympathy proportionate to its importance. Most of us have depended too much on the sales of new cars to new customers, through new and spectacular advertising schemes, with ever changing models marketed through new a crop of dealers.

"Motor cars, in the future, are going to be sold from the back door of the shop rather than from the sales floor, across mahogany tables. Those of us who expect to survive keen competition in a permanent buyers' market must get our 'house in order.'

"As a product attains a wide distribution the prospective purchaser becomes more or less immune to our advertising and sales activity and more and more under the influence of his friends who have had experience with the product in question. Whether the product receives an endorsement or condemnation depends largely upon the efficiency of the service that has been and is being rendered.

### *Maintenance First Consideration*

"Efficient maintenance will eliminate the saturation point—it will remedy the 'pirate' parts evil, and it will do more than anything else toward stimulating the used car market.

"Efficient maintenance is the most effective insurance to take out on the future prosperity of the automotive manufacturer.

"We must sell maintenance first and motor vehicles second. No matter how perfect the design and workmanship of so intricate a product as a motor vehicle, it cannot and will not stand up and give a satisfactory account of itself unless it is kept in a first class condition through systematic inspection, adjustment and parts replacements. And by the same token, even a second-rate vehicle can be kept going beyond its normal life if it is properly serviced.


Everybody in the Organization Sells

"When such a mechanical product as an automobile is sold maintenance is a necessary corrollary to sales and advertising. One of the fundamental principles of management, therefore, is that service, sales and advertising are essentially interrelated and must be governed by the same general policy if perfect coordination is to be effected.

"Maintenance is not a matter of minor concern, to be considered after the purchase of a car, as a mere incident. It is of major importance. Properly coordinated with selling and advertising, maintenance policies should be the most powerful means of building up your business.

"Nothing in business is more essential than making friends. Model maintenance will make more friends for the motor vehicle industry than can be gained in any other one way. Service cannot be good unless it is intelligently planned, properly systematized and everlastingly followed up. The service function must be performed dependably and uniformly everywhere that there is a need for service. And it must be performed economically, so that the customer who is served will feel that he has been fairly treated.

"In the future automobiles and the service that must inevitably follow will have to be sold hard—our most valuable allies are our car owners whose continued good-will rests largely in the hands of our maintenance men.

"The new era is bringing with it new standards and right

today the car owner and the prospective car owner are comparing our service with the service of the department store, the drug store, the jewelry store, the restaurant and other well regulated institutions.

### *Sales and Maintenance Activities Must Be More Closely Knitted*

"Our salesmen must work in closer co-operation with our service department. When the owner has trouble he calls on the service man to remedy it—not the salesman. Therefore, the service department should have something to say regarding the claims and promises of the ultra-enthusiastic salesmen.

"When a salesman resorts to untruths or to promises which he knows cannot be fulfilled it is an admission that he is lacking in real sales ability.

"The car salesman should not be allowed to let his customer drop immediately after the first sale is consummated. It is not only proper but profitable that he continues his interest in his customer and not pass the entire burden on to the service man. In a retail organization where such a policy is followed, the salesman will be more careful in his sales tactics and disappointed owners will be supplanted with satisfied and permanent customers. The far-sighted salesman will make it a point to call on his customers from time to time—he will help the service man to keep these customers sold and he will be amply rewarded for the time and effort involved.

### *Three Kinds of Service*

"Service in terms of our industry, divides itself into three classifications:

**1—Parts manufacturers and distribution.**
**2—Mechanical repair work.**
**3—Moral or psychological service.**

"I want to impress upon you particularly the importance of the third classification, namely moral or psychological service.

"The service man is essentially a salesman—in fact, he must be a super-salesman. The new car salesman, generally speaking, sells the customer only one time. The service salesman, on the other hand, must keep the man sold by reselling him time and time again throughout the life of the car.

And remember this—the customer is invariably in the best of spirits when he negotiates with the new car salesman, but his transactions with the service salesman are usually under the most exasperating conditions.

### *The Customer's Frame of Mind*

"When a man drives his car into your elaborate service station, there are usually two things wrong:

First—The mechanism of his car.

Second—His frame of mind.

It is not enough that the car shall be properly repaired—that is only half of the job—the customer has not been properly served until his frame of mind has been repaired.

"I have put service last in this address, for the sake of emphasis. But in the big job of bringing business back the ideals of service should come first. We automobile men did not originate the idea of service, but I believe we are entitled to the principal credit for the development of modern business ideals of service. When anybody speaks of a service station, the hearer thinks at once of a place where the needs of a motor user are served. The great automobile business has outgrown all precedents, principally because its service ideals and accomplishments have been unprecedented in business history. We must not forget the obligation of service as an essential, in fact as the principal essential to success in bringing business back.

"If the purchase of an automobile itself completed the selling transaction, if we had nothing but motor cars to sell, our industry would be dead instead of dynamic. Service is the galvanic life current that vitalizes the automobile business. Service must pulse through all the arteries of our industry, must penetrate into every capillary. If for any cause service to motor car owners should be completely stopped their automobiles would die so fast that in a month the sight of a live car on the street would be a curiosity.

### *"Give Service—Get Success"*

"Every automobile dealer should be a dealer in service first. In fact, the value of any of us in work is only service value. Even your value to yourself is measured by the amount of service purpose you transform into actual service practice. We have learned a new law in business, that we call "Give and Get." It particularly applies to the automobile business unless you give service and cannot get success.

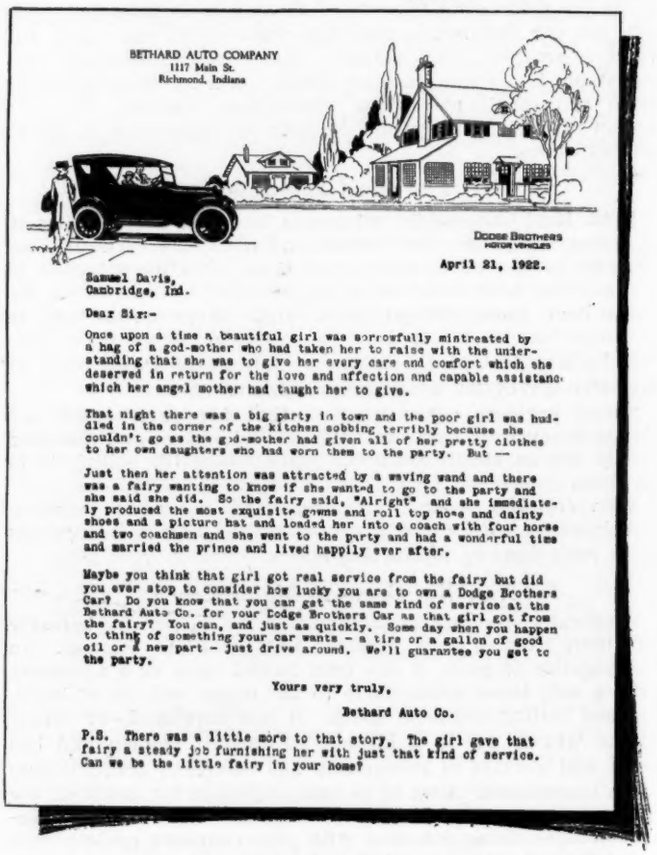
"When we look at our selling and advertising fields from the viewpoint of service first, we see immensely broadened, instead of narrowed opportunities for doing business.

"Several years ago I read a want ad that epitomized the essentials so much need in business today:

> "'WANTED—CLEAN - CUT, WIDE - AWAKE, ABSOlutely straightforward and courteous salesman; men broad enough to realize that service is more than a sale; that good-will begets more sales than solicitation; that honest merchandise can be sold for just what it is without the aid of superlatives; in brief, that vision and character are the elements of lasting success.'

"In the greatest Book that ever was written there is a verse that reads, 'And now abideth Faith, Hope, and Love—these three. And the greatest of these is Love.' I have found in that old book all the essentials of living. We need go nowhere else to find how to bring business back. Translated into the terms of our subject, advertising typifies Faith, salesmanship is an expression of Hope and service embodies recognition of the all power of Love."

## Cinderella Lends a Helping Hand



BETHARD AUTO COMPANY
1117 Main St.
Richmond, Indiana

DODGE BROTHERS MOTOR VEHICLES

April 21, 1922.

Samuel Davis,
Cambridge, Ind.

Dear Sir:-

Once upon a time a beautiful girl was sorrowfully mistreated by a hag of a god-mother who had taken her to raise with the understanding that she was to give her every care and comfort which she deserved in return for the love and affection and capable assistance which her angel mother had taught her to give.

That night there was a big party in town and the poor girl was huddled in the corner of the kitchen sobbing terribly because she couldn't go as the god-mother had given all of her pretty clothes to her own daughters who had worn them to the party. But —

Just then her attention was attracted by a waving wand and there was a fairy wanting to know if she wanted to go to the party and she said she did. So the fairy said, "Alright" and she immediately produced the most exquisite gowns and roll top hose and dainty shoes and a picture hat and loaded her into a coach with four horse and two coachmen and she went to the party and had a wonderful time and married the prince and lived happily ever after.

Maybe you think that girl got real service from the fairy but did you ever stop to consider how lucky you are to own a Dodge Brothers Car? Do you know that you can get the same kind of service at the Bethard Auto Co. for your Dodge Brothers Car as that girl got from the fairy? You can, and just as quickly. Some day when you happen to think of something your car wants - a tire or a gallon of good oil or a new part - just drive around. We'll guarantee you get to the party.

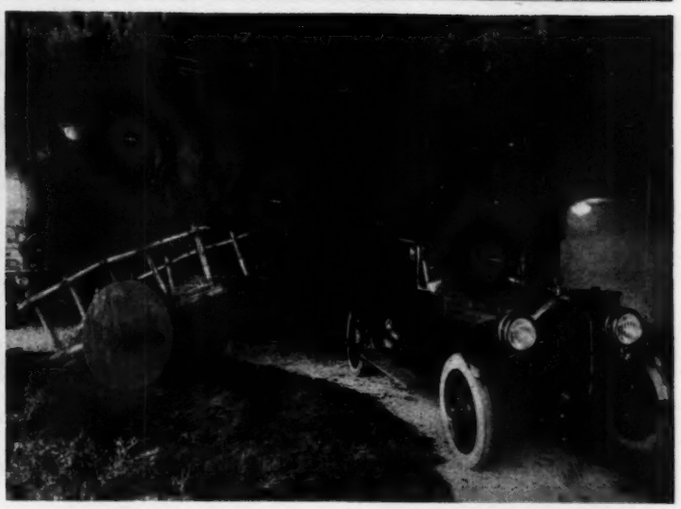
Yours very truly,

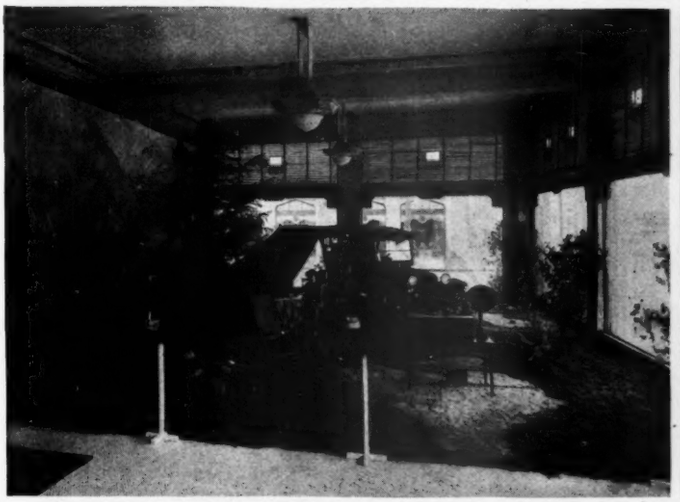
Bethard Auto Co.

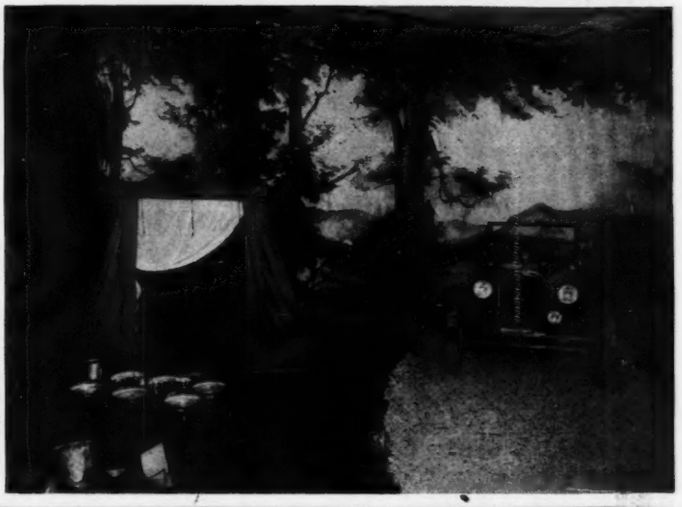
P.S. There was a little more to that story. The girl gave that fairy a steady job furnishing her with just that kind of service. Can we be the little fairy in your home?

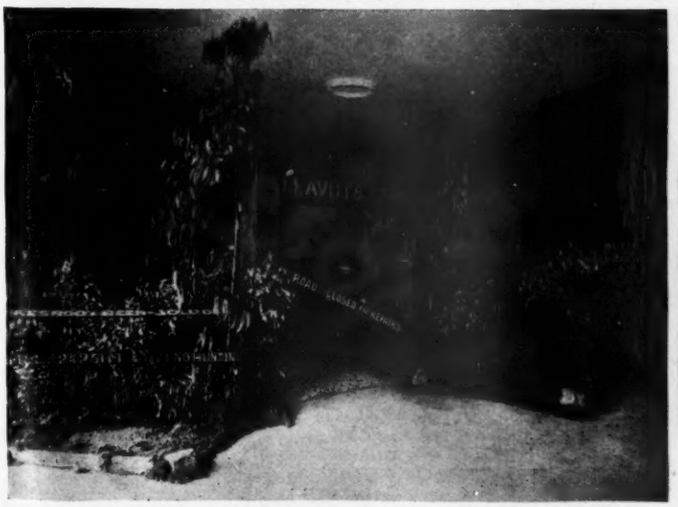
***The clever sales letter reproduced above is a type far removed from the cut-and-dried and usually uninteresting printed matter used by some dealers. It breathes that spirit of willingness to serve so emphatically demanded by Norval Hawkins in the foregoing article. After you have read it you will agree that something like it would be just the thing for your next letter.***

# How Dealers Attuned Their Showrooms to "Call of the Road Week"

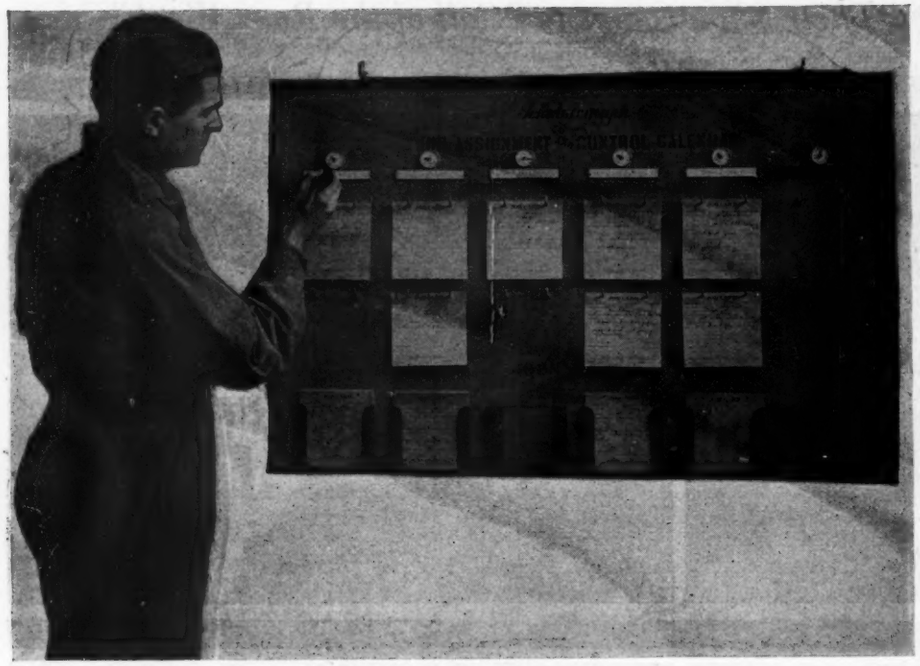








*First column, top to bottom—Color was abundant in the Chandler display with cherry trees in full blossom, green sod and sporting clothes for the models. The advantage of a radio outfit as part of the camp equipment was indicated in the Dodge display. The Oldsmobile dealer, Leavitt, found this way to advertise his name. Second column, top to bottom—The Paige room imitated San Juan Capistrano Mission; the carreta and touring car with California top contrasted the old and the new. One corner of the Oldsmobile room. Greenery was used to excellent advantage in the Apperson display.*



## The Schedulegraph, a Job Assignment and Control Calendar

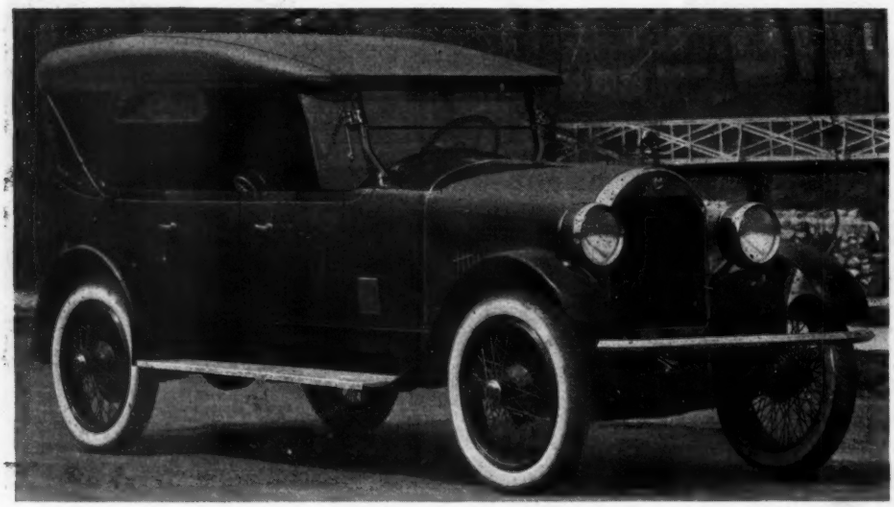
THE schedulegraph is a recording device for use in automotive repair shops and through its use, it is said no time is lost by the mechanic between any two jobs. The arrangement is such that the mechanic knows at all times just what his next job is going to be.

A job card is made out for every operation to be done, usually by the shop foreman or inspector, as the case may be. These cards ordinarily are carried in the pockets at the bottom of the board and which are marked "Jobs Ahead." Just above these is a series of hooks marked "Next Job Ahead," while the top row is marked "Job Being Worked On." Obviously the top row of hooks contains those cards relating to the work being done at the time by the mechanics. At the top of the board appears the names of the mechanics and clock dials to indicate the time at which the operation was started.

When a mechanic has finished with one job he takes off the card hanging on the top row of hooks and moves the card below in its place. He next places the hand on the clock dial to coincide with the time of starting the job. The foreman easily can look over the cards in pockets below and route the work as he sees fit. If he wishes, for example, to get a certain job out quickly and wants a certain man to do the work, he merely hangs the job card under the man's name on the hooks "Next Job Ahead."

In selecting next jobs for a workman the foreman should review all the cards in the pockets. Selections should be made on a basis of (A) what time is job promised in comparison with other jobs in the pocket (B) is material and supplies on hand (C) does man need help on job, and is there a man available (D) assign jobs in sequence that will prevent holdovers of short jobs.

The schedulegraph is made of wood and measures about 2½ ft. by 4 ft. All trimmings are of brass. The board is painted gray and varnished. Ordinarily it is suspended by two screweyes. The board and complete equipment is made by the Production Service Co., Urbana, Ill.



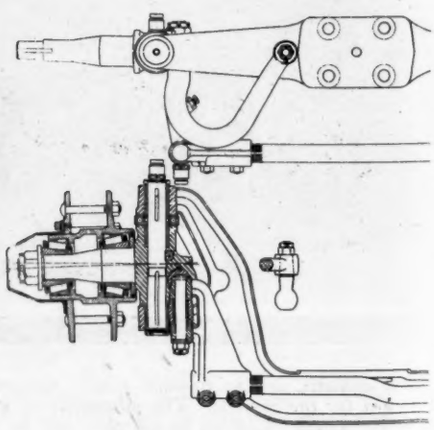
*The new Pilot Sportster carries barrel-type headlights with cowl lights to match, also polished aluminum side-steps with individual fenders, aluminum trunk rack with protecting bars on back of body and other features. Same equipment may be had on other Pilot models*

## Gardner Has Several Chassis Changes

GARDNER cars are now coming through with 32 by 4 in. cord tires, drum type headlamps and beaded crown fenders. Aside from these visible changes there are several points on the chassis which have been made either stronger or altered with the idea of more convenience and comfort to the driver and occupants of the car.

The chassis frame is now made of 1/16 in. heavier pressed steel, with reinforcements for the spring brackets. The brackets also have been made much stronger. The rear axles now are fitted with new style side gears having heavier teeth, resulting in a sturdier and more substantial construction. Beginning with car No. 11442-A all cars have "spoon type" emergency brake lever, easy to operate and positive in action. Thermoid brake lining is now used on the brakes. It is 5/32 in. thick and 1¾ in. wide, ⅛ in. wider than formerly.

Since the first of April all open car bodies are equipped with two extra bolts which hold the body more securely to the frame. The front axles on all cars over No. 11578-A are now equipped with ¾ in. king pins, with Alemite fittings in place of oil cups. These pins are ⅛ in. larger in diameter than formerly, affording nearly ⅜ in. greater bearing surface.



*Shuler motor bus axle*

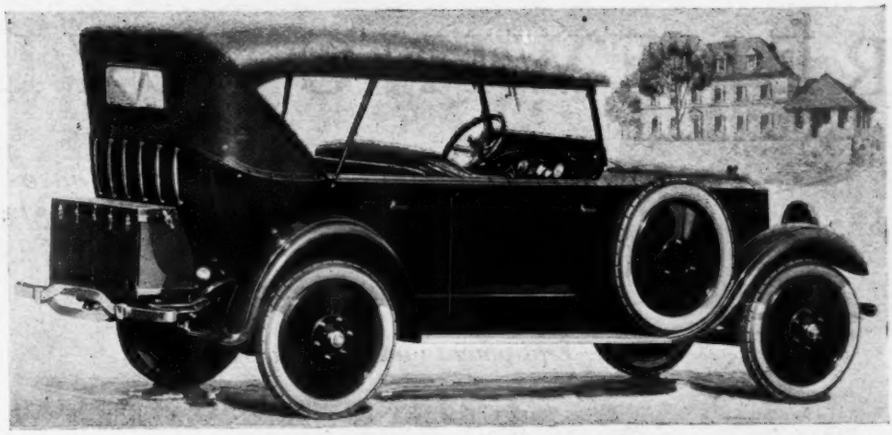
# Big Six Speedster Studebaker Latest

A FOUR-PASSENGER speedster has been added to the Studebaker line. The new body is mounted on the Big Six chassis and as is customary with the sporting type of car has many features which make for stylishness and comfort to the occupants.

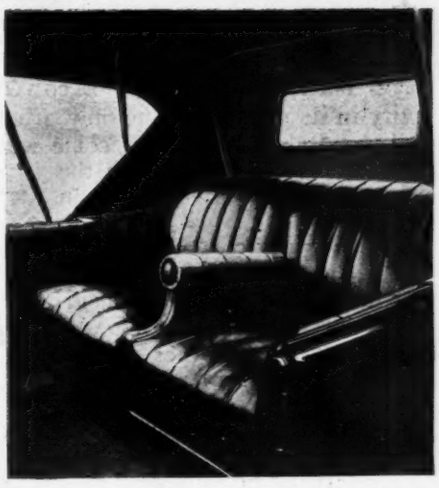
Among the innovations presented in the speedster is the upholstered dividing arm which is a feature of the rear seat design and by means of which riding comfort is increased.

The new model is priced at $1985, f. o. b., Detroit, and at this price includes a number of features such as the courtesy light, the traveling trunk and trunk rack, front and rear bumpers, and disc wheels, including two extra wheels with non-skid tires and tubes, mounted on the running boards.

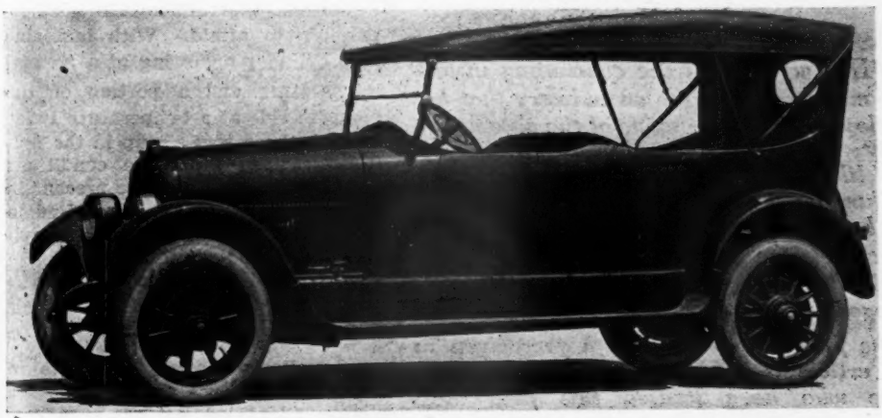
The body is finished in blue, with touches of gold striping on the louvres. Upholstery is of hand-buffed, bright-finished leather. The tailored top harmonizes with the body lines. Further touches of completeness are the massive head-lights, with artistic cowl lamps and tail lamp to match; tonneau light with extension cord, clear-vision, one-piece windshield; windshield wiper; jeweled eight-day clock; cowl ventilator; built-in, thief-proof transmission lock, ignition lock, and lock on tool compartment in left front door, all operated with the same key.



*New Studebaker four-passenger speedster body mounted on Big Six chassis*



*Dividing arm in rear seat of new Studebaker speedster*



*WITH the change in price in the Marmon lines, effective May 1, 1922, the announcement is also made of a change in wheels. Henceforth, the wood wheels will be standard and the wire wheels will be considered as special equipment and will be furnished at an additional cost of $135. Shock absorbers and the Motometer are also furnished as additional equipment at $45 and $10 respectively.*


*White rail car with a seating capacity of 41*

# Schuler Motor Bus Axle

TO meet the demand for a front axle that would meet the peculiar needs of a motor bus, the Shuler Axle Co., Louisville, Ky., has brought out a front axle of heavy design, with the spring pad a full 7 in. lower than the ordinary bus axle. The axle has a large factor of safety and large journal surfaces. The axle center is drop-forged and heat treated. It is I-section throughout its length. The yokes are bushed with steel bushings, hardened and ground. The wheel bearings are Timken, with adjustments on the spindles. Hubs are of malleable iron, provided for wood wheels. A lock washer is provided to prevent a wheel from coming off the spindle, should a bearing be accidentally destroyed. Between the knuckle and upper yoke a ball thrust bearing is interposed to insure easy steering and absorb the thrust load.

# White Rail Car

The white rail car has a seating capacity of 41 and a baggage compartment directly in the rear of the driver, who controls the car from the right-hand side. The body is of semi-steel construction. There is a four-wheel pivotal truck in front and two wheels in rear. It is governed to a speed of 33 miles per hour.

# RENEWING CYLINDERS

## *SOME Data on An Important Phase of Automotive Maintenance—An Operation That Involves a New and High Standard of Craftsmanship and Unusual Materials and Equipment*

### *Part I—Equipment and Tooling Up*

By PAUL DUMAS

THE effects of any one certain condition are not always traced to their ultimate cause until the effects have shown themselves over a prolonged period of time, or through a marked upset in the daily program of events. The aniline dye situation of a few years back brought about a corrective industrial activity in its particular line only after the effects of poor and unsuitable dyes had become widespread.

Perhaps on a lesser scale the shortage of the once common volatile engine fuel has produced a similar corrective activity in the automotive industry. The drop in volatility, if considered the largest factor, was aided by certain other factors such as the war time; high pressure production of engines and cars. Also by the frenzied attempts to design cars and build cars to fill the many orders that poured into the various factories immediately after the signing of the armistice. The inevitable result of the two last named items was a noticeable lack of the prewar quality of the manufactured units. The specific effects of the lack of old style gasoline and the specific effects of intensive production methods have shown themselves in many ways.

**A Branch of Maintenance**

***THIS article and the concluding installment will describe an industry that has developed within the scope of the automotive maintenance industry within a short period. It is likely to see considerable changes, but the fundamentals here described will remain the basis. Processes may change, but the objects of the operations will not change until the motor plant of the vehicle is changed.***

***The figure of $60,000,000 a year given in this article is regarded as conservative by those who have studied this field most closely.***

A casting of gray iron or of any of its compositions is not suited to immediate service, especially where the casting is employed as a part of a device or machine wherein accuracy of dimensions are a requisite to the successful continued operation of that device or machine. A casting, like a piece of freshly cut timber, is considered "green" or unseasoned until it has undergone a seasoning process.

Certain internal stresses are present in the green casting which if they are not removed will cause a distortion or variation in the dimensions of that casting. The same holds true of the freshly cut or green timber which possesses the same internal stresses which are due in this case to the variation in moisture content in the timber. The various processes of seasoning the wood are similar to the methods used to season the metal casting.

In both cases the surest method though it is far from the quickest is the slow process of "ageing." Where the exigencies of production demand speed, a different process is utilized. In the case of the green casting it is placed in an annealing furnace where the effects of high temperatures tend to relieve the varying internal stresses and to produce a balanced condition. The dry kiln in the lumber industry was the means of producing the same effect to the wood or timber. It is probable that in some instances the cylinder casting used in some automobile engines received no annealing or seasoning treatment whatsoever, during the period of frenzied production.

It is certain that in some cases the design of water jacket spaces were such that no attempt was apparent towards securing even temperature values on all sides of each individual cylinder bore. Although the cylinder casting may have been thoroughly relieved of all internal strains the distorting effects of unequal temperatures due to improper design of water jackets nullified the benefits of thorough seasoning.

Efficient lubrication under such conditions was difficult if not impossible to attain. With one side of a cylinder operating at a normal temperature and a portion of the opposite side at a temperature twice as high there was set up in the cylinder casting the same conditions of internal stress as were present in the green casting. This resulted in premature wear of pistons and cylinders.

### *Effects Traceable to Fuel Characteristics*

The effects directly traceable to the characteristics of the fuel were many and varied and are accountable for the great amount of corrective and research activity which is now in progress. The present fuel will not vaporize under the same conditions and with the same vaporizing equipment as was used eight years ago. Besides showing no tendency to vaporize it has shown a tendency to produce strange noises or knocks which are technically called pinking, detonation, etc.

There has resulted from this a concentrated endeavor on the part of the engine designer and the scientist versed in thermodynamics to develop by study and experimentation either a suitable fuel for the present design of engine or an engine suitable for the present fuel. The carbureter designer is working hand in hand with the car designer and the scientist. Whether this development work will result in something new and radical in fuels or something new and radical in engines remains to be seen.

At any rate it is safe to assume that the results will not be only corrective but a step further towards more efficient heat utilization. This briefly is the effect of the fuel situation among the engineering circles of the industry. It has also produced a marked effect on that portion of the industry devoted to the service and maintenance of the vehicles now in operation.

The question of lubrication at once arises because the fuel by diluting the lubricating oil not only causes a drop in its anti-friction qualities but also causes a rise in the amount of oil required to maintain safe lubrication. Thus there is presented the problem of securing greater oil mileage and the

problem of the recovery of the used oil. The latter problem has in the past been almost entirely neglected although the economies of oil recovery have long been recognized among the users of large power units and heavy machinery. At present we find that this phase of the situation is receiving its just share of corrective development and we may soon see oil reclaimers installed as part of the regular equipment of motor vehicles.

It may at first seem far fetched to connect the effects of improper fuel, poorly seasoned castings and incorrect design to service and maintenance. Close analysis, however, will show that the epidemic of so-called oil pumping, loss of compression, scoring of cylinders, lack of power and tendency to knock of most automobile engines are the direct effects of either one or all of the above conditions. Conclusive proof of this can be found by the statistics concerning the volume of business done by the concerns engaged in the manufacture and sale of piston rings for replacement purposes and the cylinder regrinding shops.

Even with the improvements in construction that will come about in the future there will always be an amount of cylinder regrinding and reboring and fitting of over-size pistons. This is inevitable because only a small per cent of all the cars manufactured are marked off until they have had a minimum mileage of something in the neighborhood of 50,000 miles. The business of regrinding and reboring has been greatly accelerated as seen above on account of the excessive amount of wear or in some cases distortion that was traceable to the three mentioned conditions.

With normal wear the engine that has turned 40,000 miles will require reboring or regrinding at least once or twice during this period. The average car will cover this mileage on an average of once every five years. There are slightly more than 10,500,000 motor vehicles in the United States which gives a potential market of better than 2,000,000 engines yearly. The mean average engine is a five-cylinder engine with an average price on regrinding of these five holes of approximately $30. This provides then a potential volume of business of $60,000,000 yearly. These figures do not include motorboat or airplane engines. At present there are not more than 900 to 1000 shops where cylinder grinding is done. This of course does not include the many shops where equipment is installed for reaming cylinders.

### *Boring or Reaming*

The question of cylinder boring and reaming versus cylinder regrinding is many sided. Although to date the grinding faction are doing perhaps a greater volume of business than those engaged in cylinder reaming. The cost of reaming is much less than the cost of grinding because the cylinder casting may be reamed without removing the engine from its foundation. A non-uniform casting is difficult to ream accurately and a thin walled casting requires that extreme care be exercised to prevent bulging of the wall during the reaming operation. The reaming process is at its best on thick-walled castings of uniform wall texture.

Where reaming is the method used in the engine factory, it is usually aided by an additional process which is used to produce a smoother and harder surface to the cylinder walls. To secure this effect the cylinder bores are put through an operation wherein the walls are rolled or honed.

The rolling or honing is done after the bores have been reamed and is accomplished with a tool which carries a series of hardened rollers which have a slight taper sufficient to feed through the cylinder. The tool is adjustable to secure the necessary expansion and the cylinder walls are subjected to the treatment for a length of time sufficient to pound down the minute irregularities of the wall surface and produce a smooth and hard finish.

Power and hand driven portable reaming equipment is now available which is giving uniform satisfaction and is being used extensively. As the use of reaming equipment is not as complex as the grinding method and because nearly every one is familiar with the operations and principles involved, we shall devote more space to the principles of cylinder grinding and the fitting of pistons, pins and rings. The cost of the equipment necessary to operate a grinding shop will vary between $3000 and $8000 depending on whether the machinery is bought new or second hand and whether finished or semi-finished pistons are used.

### *Itemizing Equipment Required*

Itemizing the equipment required to operate a shop where finished pistons are used would be something like the following:

| | |
|---|---|
| One cylinder grinder fully equipped | $2400 |
| One small external grinder | 800 |
| One back geared drill press | 350 |
| One sensitive drill press | 125 |
| One electric motor or other source of power (15 to 20 h. p.) | 250 |
| One emery stand | 50 |
| One 12 in. lathe | 550 |
| One 16 or 18 in. lathe | 800 |
| Expanding reamers sizes one-half in. to one and one-half ins. inclusive | 200 |
| Shafting hangers and belts | 200 |
| Benches and hand tools | 350 |
| Precision measuring instruments (micrometers and dial indicators) | |
| Stock of pistons, rings and pins | 160 |
| Office furnishings | |

The external grinder and the 16 in. lathe and back-geared drill press may be eliminated if finished pistons are used. The choice of cylinder grinding machines will be drawn from a field of not more than four manufacturers. Three of these manufacturers make dry grinding machines and one firm claims that it has successfully solved the problem of wet cylinder grinding. The wet grinding process is an insurance against local or spot heating of the cylinder wall and the tendency to distortion. A higher gloss or polish is applied to the cylinder wall which would tend to somewhat retard wear. Builders of the dry grinding machines state that the introduction of water in the vicinity of the grinding wheel causes clogging because the cylinder is not quickly scavenged of the water and cuttings, and that very little water reaches the point of contact between wheel and cylinder, which is the point where it is most needed. The theory of wet grinding can not be well denied as wet grinding is utilized on the majority of external grinding machines. The price of a high grade cylinder grinder will vary according to the make and particular model from $2000 to $2800. The external grinder to be used for finishing grinding of pistons and pins can be purchased in various sizes and will sell within a price range of $400 to $1500.

The back-geared drill press may be dispensed with but is a valuable adjunct and will cover a wide range of work. It may be purchased second hand for as low as $75 and could be bought new for approximately $350. The sensitive drill press is a necessary item and its cost is low even for a new machine, it being somewhere in the neighborhood of $100.

### *Selecting Power Plant*

It is impossible to arrive at an average price for the cost of the power unit as the locality will determine the most economical power to use.

The power requirement should be purchased with the view that future growth may require additional power which means that the shop should be overpowered if anything. This pertains to those localities where electric power is not economically available. Where electricity is the motive power, it will be found that individually driven motor drive machines will decrease the monthly current bill although the individual motor drive is far more costly to purchase.

By buying finished pistons the original cost of the necessary equipment will be materially reduced but the lathe is practically indispensable in any shop. A suitable lathe for general work sells for approximately $600.

A full set of the necessary reamers would necessitate a money outlay of about $200 in round figures.

Probably the most important item is measuring instruments.

## General Average Regrinding Prices

| Size | No. Cyl. | Average |
|---|---|---|
| Under | 2 | 21.65 |
| 3 in. | 4 | 40.85 |
| | 6 | 58.25 |
| | 8 | 75.00 |
| | 12 | 105.25 |
| From | 2 | 22.85 |
| 3 in. to | 4 | 43.80 |
| 3½ in. Dia. | 6 | 61.00 |
| | 8 | 77.25 |
| | 12 | 117.00 |
| From | 2 | 26.25 |
| 3⅝ in. to | 4 | 47.25 |
| 4 in. Dia. | 6 | 68.75 |
| | 8 | 90.25 |
| From | 2 | 29.00 |
| 4⅛ in. to | 4 | 52.75 |
| 4½ in. Dia. | 6 | 74.25 |
| From | 2 | 31.50 |
| 4⅝ in. to | 4 | 58.00 |
| 5 in. Dia. | 6 | 80.25 |
| From | 2 | 34.00 |
| 5⅛ in. to | 4 | 62.25 |
| 6 in. Dia. | 6 | 91.75 |

The variation in price lists issued by regrinding concerns is due mainly to a difference in their geographical location which directly affects the overhead and operating expenses. Where more than one regrinding shop is located in the same city or town the prices quoted will show not more than 10 per cent variation. Generally speaking the highest prices prevail in the south and west portions of the United States, the eastern section is next highest and the lists printed by the concerns in the middle west are the lowest. The list shown above is a general average taken from representative price lists from four different sections of the country. The variation in the lists from which this average pricing was secured showed a maximum difference of 45 per cent from the lowest to the highest. The prices given are list in every case and carry a discount to the dealer that varies from 10 to 40 per cent.

The micrometer, both inside and outside, is absolutely necessary. The success of the entire regrinding process depends on securing the proper tolerances. The clearance between the cylinder and piston measured at the skirt and at each ring land and the proper gaging of the ring grooves and the piston pin hole can be accurately measured only by the use of precision tools.

The micrometer is the tool best suited for nearly all of this work. The dial indicator is valuable in securing comparative readings of the individual bores of any one block or series of blocks of the same make and size of engine.

The items such as benches and hand tools are too well known to require description. They include the combination square, wrenches of every description, hacksaws, blowtorch, vises, hammers, files, etc. At least two bench vises are necessary and possibly two to four piston clamping vises. A universal aligning jig, which will accommodate every size of connecting rod is a necessary requisite and no job should be considered complete until each connecting rod has been accurately straightened, before delivery to the customer.

### *Stock of Pistons and Rings*

The average expanding reamer has a range of diameter variation of approximately .015 or roughly 1-64 of an inch. To fully cover the steps in sizes from half-inch to one and one-half inches there will be 64 reamers needed. The majority of connecting rod small end bearings and piston pin sizes can be fully covered by about half this number of reamers and before purchase is made the equipment, lists which are distributed by large manufacturers of piston pins, should be carefully studied.

The stock of pistons and pins and rings to be carried depends on several factors. If the shop is equipped to handle semi-finished pistons there will be no necessity to stock oversizes. The semi-finished piston may be finished to any over size up to about .060.

A survey of the potential market in the vicinity of the regrinding shop will be beneficial in building up the right stock of piston rings. If out of town advertising is done it will mean that a greater number of sizes must be carried and only the experience gained through time will determine the sizes on which to concentrate. A study of the ring sizes of the large producers of vehicles will enable the shop owner to make up his original or preliminary stock of rings. The business in rings will be confined mostly to the oversizes of each standard or leading size. It is important to bear in mind that if aluminum or aluminum alloy pistons are sold, they should always be fitted with nothing but a concentric type of piston ring.

### *When Do Cylinder Bores Need Renewing?*

No certain accurate or definite external indications can be depended on to tell when a cylinder must or should be rebored or reground. External indications offer a basis of diagnosis, however, which if followed out sensibly will point to the place wherein the final decision should rest.

Oil pumping is not definite proof that the cylinders are in need of regrinding although it is a possible indication. The same applies to a lack of power and extravagant use of fuel. These conditions may be caused by non-circular cylinders and pistons but they may also be caused by leaking valves, improper carbureter adjustment or a deranged ignition system.

To definitely determine when to regrind it is advisable to make accurate measurements of the diameter of the cylinder bore and of the piston. Providing that the cylinders are comparatively circular a great amount of clearance may exist between cylinder and piston without any loss of power or tendency to overoil, but a slight variation from the circular may produce both evils. As there is no hard and fast rule governing it, there can be no hard and fast limits set as to the maximum allowable variation from the circular. It is not unreasonable to assume that if the greatest fuel efficiency is desired that a cylinder of average size should be reground when this variation has reached a value of .004. A bore that is .004 out of round cannot practically be lapped to absolute roundness. Regrinding or reboring would be more economical.

### *Knowledge of Factory Oversize*

A knowledge of the factory recommended over size is of great value to the shop doing regrinding. In some cases the car maintenance stations of some makers do the piston installing in their own shops. In many instances the car makers supply finished over size pistons which are more economical to purchase than from the cylinder grinder. This means that if trouble is to be averted it will be necessary to grind to the exact over size desired by the service station. A variation in the cylinder bore diameter if over size will produce a sloppy job and if ground under size there is the danger of the pistons seizing.

Frequently no particular attention is given to the cylinder diameter dimensions by the man who is installing the pistons. He has taken it for granted that they are of the proper size and if the piston will enter the cylinder without any visual amount of excessive clearance his interests have been satisfied. Considerably more damage has been done through too little clearance than through excessive clearance.

The natural impulse is to secure as tight a fit as possible and oftentimes the effects of the temperature of operation are overlooked. When the customer brings in a block for regrinding only, it is for the best interests of all concerned to determine the exact diameter of the pistons that are to be installed in that particular cylinder block. All of these things

should be considered before the actual grinding operation is begun.

### *Use of Dial Indicator*

The use of the dial indicator will be found beneficial in impressing the customer of the need of regrinding. Whenever an engine is dismantled, the cylinder bores should be gaged with the dial indicator or better still allow the owner of the car to perform the operation himself with the dial indicator. The functioning of the dial indicator is shown in Fig. 1.

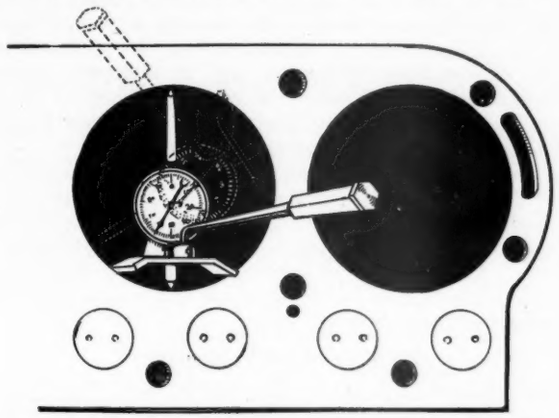


*Fig. 1—The dial gage applied to a cylinder bore to quickly determine how much it is out of round. As a method of securing comparative readings, the dial gage is particularly fast and accurate. The readings are registered on a dial which enable the owner who usually is unable to read micrometers to actually see the condition of his engine's cylinder walls.*

The process of grinding cylinders is fundamentally the same regardless of the type or particular make of the machine being used. The operation of setting up the work is the lengthiest single item and to reduce the time element and to secure greater accuracy, the leading makers of grinding machines have produced very efficient fittings. A view of the jig as furnished with one of the best known machines is shown in Fig. 2. This type, with very slight modifications, is used on

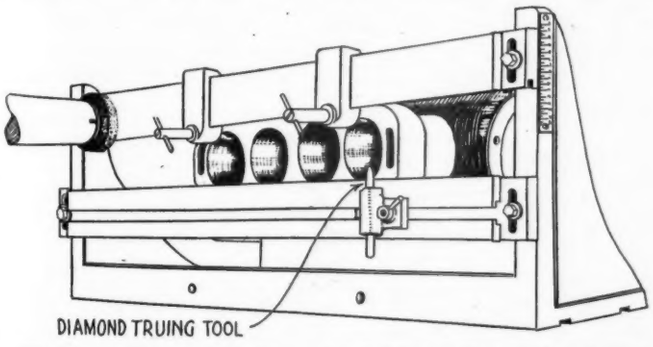



*Fig. 2—A typical stock fixture for holding and centering the cylinder block while it is being ground. The diamond truing tool is handily located and is movable on the adjustable cross bar of the jig. The grinding wheels are trued many times during the grinding operation.*

the machines produced by the other two firms which are representative of the field which is confined to less than five different makers. The operation of the jig is as follows:

The diameter of the hole to be ground is first determined then the top bar of the jig is moved to a point where the mark on it will coincide with the same reading in inches stamped on the end of jig base. This scale is also stamped in the same relative position on the opposite end of the jig. The bar is then securely bolted in position. The locating brackets are slid along the bar and are positioned a distance from each other equal to approximately the distance from center to center of the end holes of the block to be ground.

The block is then lifted up on these brackets and bolted in position, after which the brackets are removed to allow grinding room. The final centering operation consists in setting the movable table of the grinding machine so that the grinding wheel will touch approximately at every point on the cylinder at each revolution of the wheel arm. When this position is secured the actual grinding operation is begun.

### *Success Depends On Several Factors*

The success of the job depends on several factors, a few of which are selecting the proper wheel for the type of cylinder being ground, proper wheel spindle speed and feed, proper balance and trueness of wheel and the prevention of uneven heating of the block during grinding. Cylinders show a wide variation of hardness and a wheel that would be best for a Mack engine or Packard would be ill suited for a block less hard. Too hard a wheel will glaze or load and a wheel that is too soft will wear rapidly. The recommended wheel speed for various sized wheels differs but slightly among the different grinding machine makers.

An average for two and one-half to three in. diameter wheel would be 7000 r.p.m. with a decrease in the recommended speed as the diameter increases. The number of revolutions are varied to the different diameters of wheels in order to maintain a fairly uniform linear or peripheral speed in feet per minute of the grinding wheel, regardless of its diameter and this is best done by a variation in the revolutions per minute of the wheel spindle. The very high speeds of rotation require that a condition of practically perfect balance exist in the wheel otherwise vibration will be set up, and as a consequence an out of round hole will result. This out of balance condition is also very detrimental to the spindle bearings of the grinder. It is probably safe to assume that granting that the proper grade wheel has been selected that unbalanced wheels are the greatest cause of worry to the cylinder regrinder operator.

A wheel once balanced does not remain permanently so, owing to a lack of uniformity of the abrasive construction. It is for this reason that grinding wheels are rebalanced after each few blocks have been completed. The wheels are trued up or dressed with the diamond several times during the grinding of a single block.

### *Prevention of Uneven Heating*

Prevention of uneven heating of the block is desired during grinding to insure accuracy.

Some shops fill the water jackets with water during the grinding operation to maintain an even temperature but this practice is not extensively followed. The usual method is to give each bore a preliminary roughing cut of not to exceed .005 and by the time that the last cylinder has received its roughing cut the first cylinder has cooled sufficiently to permit grinding, to finish size.

The operation of the individual makes of cylinder grinding machines is thoroughly covered in the book of instructions issued to each purchaser of a machine. In many cases individual service is furnished by the maker of the machine in which case the traveling service representatives are practical field

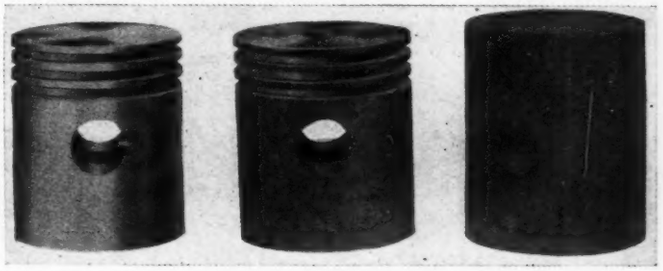


*Fig. 3—Three stages of piston construction. The view at the right is a "rough casting", the center, a semi-finished piston, which is the type usually purchased by the small regrinding and maintenance station. The piston at the left is called a finished piston. The production of pistons from the rough castings cannot be economically accomplished without the proper equipment. Pistons in any of the three stages of completion can be secured from nearly every one of the companies specializing in this work.*

men who are well qualified to handle any operating conditions that may arise which are not covered by the instruction book.

As before stated the quality of the job is best assured when the pistons are installed at the same shop where their mating cylinders were reground. The purchase of semi-finished pistons is generally the most profitable course to follow for the small regrinding shop. This is true because the small or average shop has not the necessary equipment for speedy production of pistons from the rough castings. To secure economical production a turret lathe is most generally utilized as this permits of several simultaneous operations at one setting of the work and the machine.

### *Turret Lathe*

The turret lathe is not usually found in the average regrinding shop. It is by no means impossible to produce pistons without the turret lathe but it is impractical to attempt to compete with a shop that is equipped especially for this work on a price basis.

The exact sequence of operations in machining a piston from the rough casting differs with the various large shops. In the majority of cases the piston is first held from the open end by a special fitting and while the outside is rough turned and the ring grooves cut another tool is brought up and the head is faced and center drilled. On the next operation the piston is held from the closed end and the bottom and inside of the open end are machined. The casting is then chucked on a face plate jig similar to the one shown in Fig. 4, where it is drilled at the piston bosses to accommodate the piston pin.

Where the engine is designed for offset piston pins, the face plate jig is provided with means for securing the proper centering. The jig shown in the sketch uses removable stepped washers or rings for rigidly holding the piston at its open end. The same washers are used on the stepped cone fitting which is referred to later. A piston that has received all of the machining operations referred to above is considered a semi-finished piston. The semi-finished piston is the type most often purchased by the average shop and it is this type that is considered in the text that follows.

Although there is a fair margin of profit in the manufacture of pistons from the rough it necessitates considerable capital and should not be entered into blindly or without careful study of the many angles incident to its successful inauguration. A larger personnel and more extensive equipment being one of the requirements this phase of the work is not particularly interesting to the man with limited financial resources.

### *Classes of Pistons*

The construction of pistons for internal combustion engines shows no great variation as far as structural features are concerned. The materials of which they are constructed show a wider variation but can be commonly classified under two general headings which are the iron piston and the alloy piston. The iron pistons can be sub-classified into the various alloys or iron and steel and are sometimes called semi-steel pistons. Steel pistons made from forgings were once used in very limited quantities on special racing or special aircraft engines. The constant clearance type of aluminum piston is rapidly gaining ground and it is not far fetched to say that in time it will be a close rival to the cast iron piston as regular equipment on factory productions.

The common cast iron piston is the one most generally used. A close grained iron is considered best for this purpose and the pistons should be sufficiently rigid and reinforced to stand the strains of service and still not be too heavy for high speed performance. They should be so constructed as to be able to carry away the heat of the combustion and possess the ability to expand uniformly when heated.

### *Uniformity of Expansion*

Uniformity of expansion is secured through annealing the rough casting before machining and by maintaining a uniform sectional thickness which can be accomplished only through careful casting and accurate chucking and machining. A piston with a correct thermal balance if installed in an engine and operated without sufficient cooling or lubrication would score itself uniformly and not in spots.

The most accurately manufactured piston will fail miserably if it is improperly fitted. The proper fitting of pistons consists in securing the amount of clearance most desirable to obtain a fit that is neither too loose or too tight, under normal operating conditions and temperature.

To arrive at the proper clearance for any one piston material it is necessary to find its relative expansion at different temperatures. This will give an approximate idea of the clearance to be allowed. The characteristics of the cylinder material in which the piston operates should also be known. Different portions of the piston will be operating at different temperatures so that different amounts of clearance must be allowed at the points which are operating at the highest temperatures.

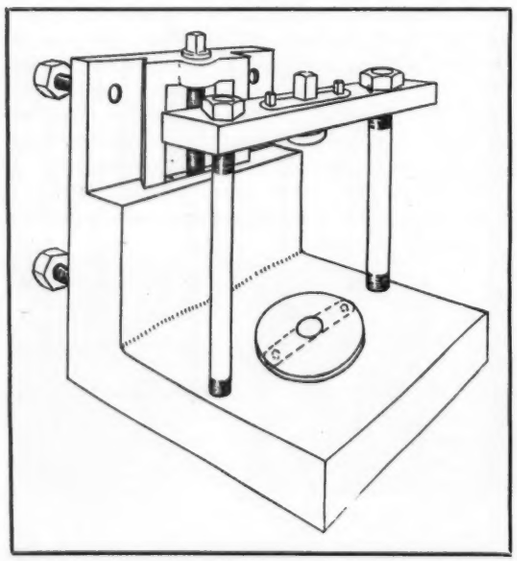


*Fig. 4—A simple form of jig for drilling the piston bosses. The bottom is provided with a fitting which accomodates the same stepped rings which are later used for holding the piston during the turning operation. Both the upper and lower holding devices of this jig are adjustable to allow for drilling pistons in which the bosses are offset. There are many modifications applied to jigs of this type many of which are much more elaborate than the one shown above.*

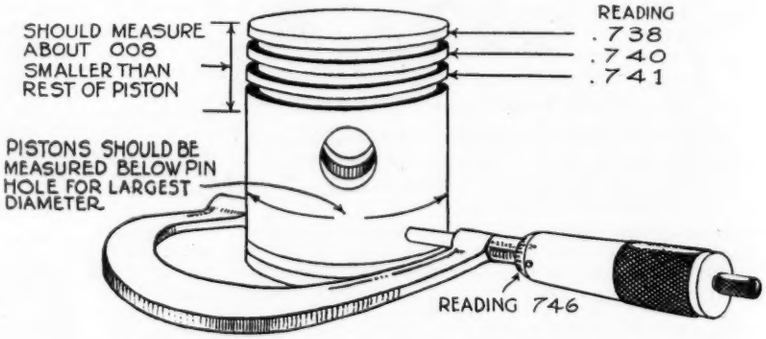



*Fig. 5—Recommended dimensions of piston to fit an engine of 3¾ in. bore. The skirt shows a micrometer reading of 3.746 in. which allows .004 in. clearance to accomodate for expansion due to operating temperature of engine. The top ring land has been reduced to a diameter of 3.738 in., while the second and third lands which are not exposed to such great heat are of greater diameter as shown by the micrometer reading.*

The most practical clearance value cannot be arrived at solely by mathematics but only through data gained through experiments in the laboratory and in every day use. It is commonly known that the head of a piston is the hottest portion of that piston at all times and it is also known that the greatest stress is exerted on the top of the piston on the power stroke.

**The recommended practices for machining and fitting pistons will be outlined in the concluding installment.**

## This List Will Be a Time Saver When an Electrical Problem Comes Up on Any of the Cars Described

The following electrical systems have been described in previous issues:

| Car | System | Date | Car | System | Date |
|---|---|---|---|---|---|
| Ford | Ford | Nov. 10, 1921 | Chevrolet FB & 4-90 | Auto-Lite and Remy | Mar. 9, 1922 |
| Dodge | North East | Dec. 1, 1921 | Maxwell 1920, '21, '22 | Simms-Huff & Auto-Lite | Mar. 23, 1922 |
| Buick | Delco | Dec. 15, 2921 | 1921 Oldsmobile Six, 37-A and B | Remy | Apr. 13, 1922 |
| Overland | Auto-Lite | Dec. 29, 1921 | 1921 Oakland, 34-C | | |
| Studebaker | Wagner and Remy | Feb. 16, 1922 | 1921 Oldsmobile, 4 & 8 Cyls. | Auto-Lite and Remy | Apr. 27, 1922 |

*Another Packer Article—*

# 1921 Hudson Using Delco System

***It is found in maintenance work on the automotive vehicle that the majority of troubles are electrical. This series will save valuable time in diagnosing the trouble and correcting it***

### ARTICLE TEN of a SERIES by A. H. PACKER

THE operation of the electrical system on the 1921 Hudson can best be studied by referring to Fig. 1, which gives the car wiring, and Fig. 2 which shows a perspective diagram of the internal circuits of the motor generator. The action of the lighting switch which effects the operation of both starter and generator is given in Fig. 3 where the connections obtained in the different handle positions are shown.

**Starter Operation**

While there is but one armature in the motor generator, it has two windings and two commutators, so that electrically it acts like two separate armatures. In the field coils there are also two windings, a fine one which produces the field when generating and a heavy strap winding which works when the starter is cranking the engine.

A general idea of the mechanical drive will be obtained from Fig. 7 where an intermediate double gear is operated by the action of the starter pedal and meshes with both the pinion on the motor shaft, and also with the teeth in the flywheel. As the armature revolves at very high speed compared with the speed of the engine, when acting as a starter, a clutch is used at the front of the generator to permit the necessary slip between the armature shaft and the pump shaft, which drives the machine when generating. Details of this clutch are shown in Fig. 5. A similar clutch is also incorporated in the larger of the two intermediate gears at the rear of the starter, so that when the engine starts on its own power, this clutch can slip and prevent overspeeding of the armature which might throw out the windings.

In checking up the starter circuits it will be seen that the battery is connected to the largest of the three terminals at the side of the motor generator, and that the circuit continues through the lower and upper series fields of the machine and then to the top brush. Referring to Fig. 7 and also to Fig. 2., it will be seen that there is a pin or rod which holds both of the starter brushes off of the commutator except when operation of the starter pedal has meshed the gears. There is therefore no flow of current due to the circuits just traced, as the connection is broken at the upper brush, which is held up from the commutator. A smaller wire however, goes from this large terminal on the side of the motor generator, to the ammeter and through the ammeter we have the circuit continuing to the lighting and ignition switch.

In starting, the operation is first to turn on the ignition switch. This in addition to sending current to the ignition coil, also sends current to the No. 2 and No. 3 terminals of the switch which connect to the two smaller terminals of the motor generator, thus allowing battery current to flow through the generator field and armature, causing it to run as a motor. At this point we must remember that the starter gears are not yet in mesh and that turning action is possible due to the slipping of the generator clutch.

The first motion of the starter pedal will now easily mesh the intermediate gears with the pinion on the armature shaft, due to the rotation above described, and this rotation will also make it easy for the gears to mesh with the teeth on the flywheel. The last bit of motion of the starter pedal will remove the brush operating pin so as to let the starter brushes drop onto the commutator, while at the same time

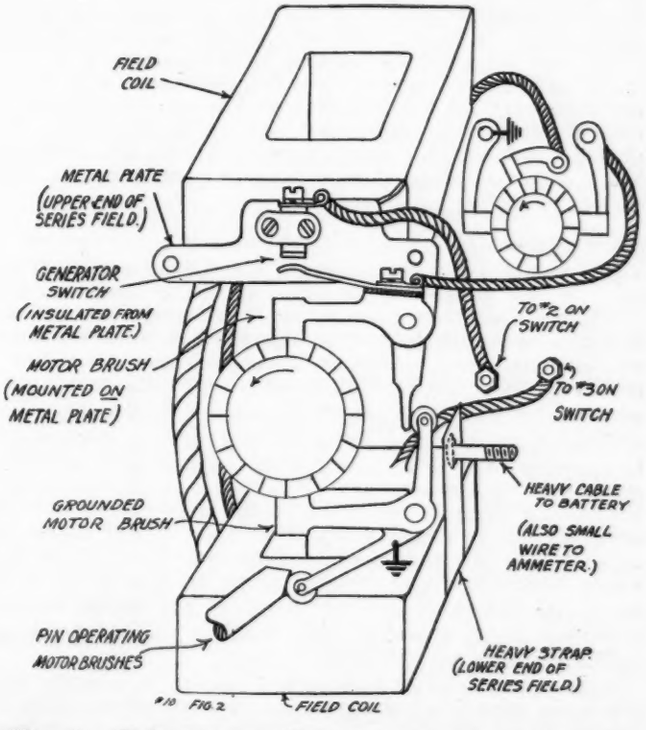
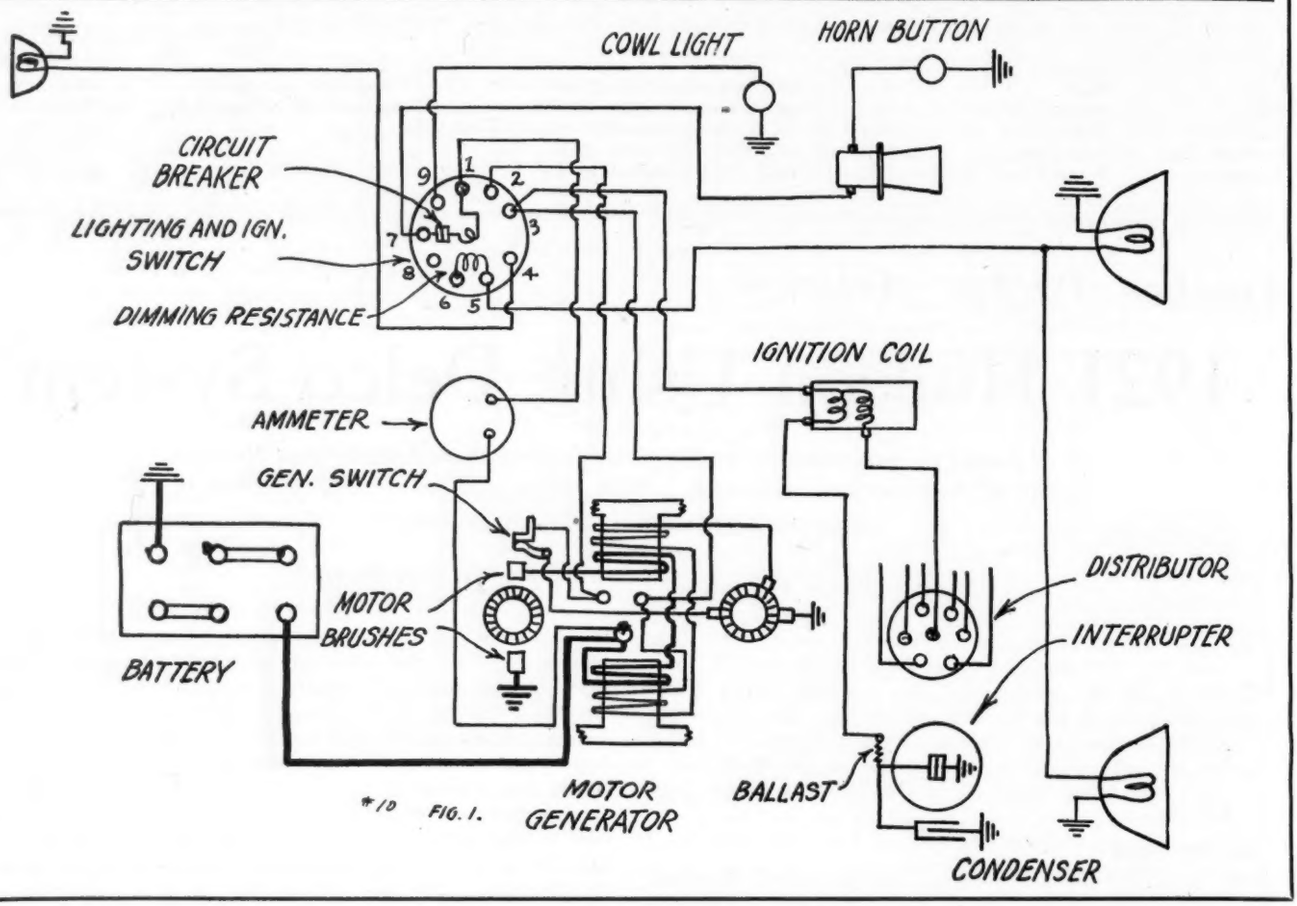



**Fig. 2—Delco internal motor-generator circuits, 1921 Hudson**

## FIG. 1—WIRING DIAGRAM OF THE 1921 HUDSON




*10 FIG. 1.

the generator switch will open, the lower finger of this switch being mounted on the upper starter brush, but insulated from it. This generator switch is indicated in Fig. 1, and shown more clearly in Fig. 2. This disconnects the live generator brush, and prevents the machine from operating as a generator at the same time that it is being used as a starter for this would put a heavy drag on the armature and make the cranking action very slow. As the engine starts, the release of the starter pedal however allows the generator brush circuit to again close so that the generator can send current to the battery.

**Starter Trouble**

Difficulty in operating the starter may be encountered if the gears do not mesh, due to failure of the generator to run as a motor when the ignition switch is turned on. The normal operation when the ignition is turned on is always denoted by a clicking sound made by the generator clutch, for in Fig. 5 it will be seen that the rollers drop into little depressions, as the outer part turns clockwise, and the rollers slip. This clicking sound produced by the rollers shows the generator is motoring, and if it does not the trouble may be either mechanical or electrical. To detect mechanical trouble the commutator cover at either end can be removed so that the armature can be turned with the fingers. It will always be impossible to turn it in a counter clockwise direction, as this would require cranking the engine through the pump shaft, but in the clockwise direction, it should be possible to turn it without much difficulty. If it can not be turned this of course accounts for the failure to motor.

If the starter is mechanically O. K., it is possible that either the field or armature circuit is open, either inside or outside of the machine. To test for a condition of this kind it is convenient to use either a six volt test lamp or a voltmeter, one lead being connected to ground or the frame of the car or engine, while the other lead is used to explore with.

This free lead should be touched to the large terminal at the side of the motor generator, and either the lamp should light or the voltmeter should show a reading. The lead should then be connected to the two ammeter terminals one at a time, then at the No. 1 terminal on the lighting switch, then at the No. 2 and No. 3 terminals and then at the two smaller terminals at the side of the motor generator. Let us assume for example that the lamp lights at the No. 1 terminal of the switch but not at the No. 2 terminal. This would show that the switch was not making contact, and the trouble would prevent the live generator brush from getting battery current, and of course would not permit the generator operating as a motor.

If the circuits are O. K. back to both of the small generator terminals, however, and the generator will not motor, it is possible that the circuit of either armature or field is open inside of the machine. This can be determined by removing the wire from the upper left hand small terminal on the motor generator and connecting it to an ammeter, while an extra wire is connected from the other ammeter terminal to this generator terminal. This puts the ammeter in series with the armature and if no current is registered on the meter, it shows the circuit is open, a likely place for the trouble being burnt condition of the generator switch or the brushes worn down so that they do not touch the commutator. In the same way the ammeter can be put in series with the field circuit to see if it is open, the normal current being about 1½ amperes. With armature circuit and field circuit O. K. and no appreciable bind in the mechanical action of the generator, motoring action is practically certain.

If the gears mesh but the starter will not crank the engine, it is well to turn on the lights and observe their appearance while the starter pedal is depressed.

LIGHTS GOING OUT indicates a poor connection in the starter circuit, which may not be bad enough to affect the

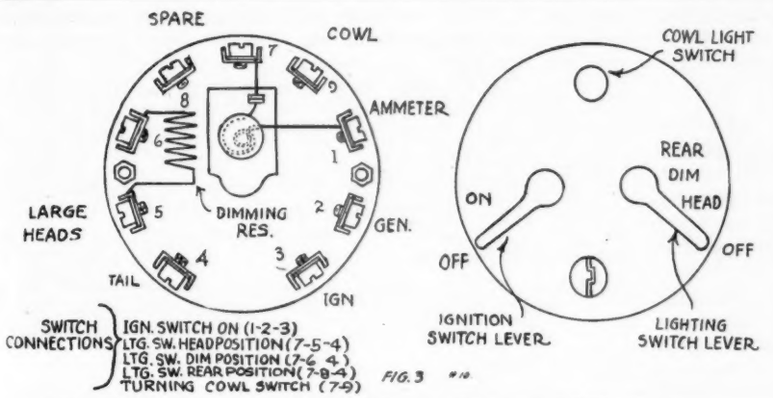



**Fig. 3—Lighting and ignition switch on 1921 Hudson**

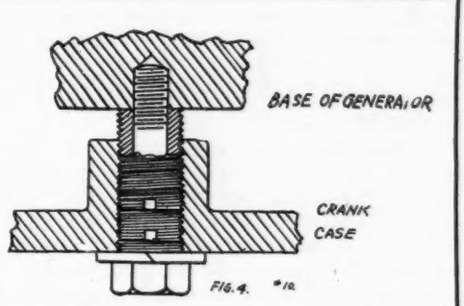



**Fig. 4 — Motor generator mounting showing adjustment for height, 1921 Hudson**

lights or the motoring of the generator, but does show up when heavier current is required. Such trouble is usually due to corroded battery terminals or poor ground connection at the frame of the car, one way of detecting the trouble being to hold the starter pedal down for a few moments and then feel of the suspected places, as current flowing through a high resistance will produce considerable heat.

For more accurate testing a voltmeter should be used, connected across the suspected contact while the starter switch is operated. This will detect not only a poor contact but also an absolute open circuit. For example the meter can be connected from the ground or frame to the terminal that is bolted to it. Then when the starter pedal is held down, there should be a barely perceptible movement of the voltmeter needle. Should the meter show a volt or two, however it shows a badly corroded connection, while if the meter should read six volts it would indicate an absolute open. The same test can be made from each battery terminal to the terminal that attaches to it. The remedy for trouble of this kind is to remove and clean the surfaces of the connections with a file or sandpaper, and in case the trouble is at the frame of the car, an improved connection can be made by coating the frame with a layer of solder, before the terminal is again bolted on.

LIGHTS STAYING THE SAME would show that the starter circuit was open, which trouble should be easy to locate, from the circuit diagram given, the most likely place being at the contact of the brushes with the commutator.

LIGHTS GETTING VERY DIM shows either that the battery is weak or with an O. K. battery that there is a short or ground in the motor, or a mechanical bind that draws excessive current from the battery. To check the battery a hydrometer can be used, readings of about 1280 showing a charged condition of the cells while 1150 shows discharge. The condition can also be checked with a low reading voltmeter, readings being taken while starter current is flowing. Readings of 2 volts at each cell show cells in fine condition while if the reading is 1.7 volts or less at one or more cells it shows a discharged condition. The voltmeter will also pick out a shorted cell, the reading being either very low or may be even in the wrong direction showing that this cell is not only dead but is a drag or resistance, hindering the action of the remaining cells.

If the battery seems to be O. K. a high reading ammeter should be connected in series with the motor generator, and the starter current observed. If this is over 200 amperes it shows that electrical trouble is present in the motor, assuming the engine turns freely and there is no binding in the mechanical operation of the starter.

### Generator Trouble

Certain difficulties in the generating system will also prevent the motoring action that is required by the starter, so that the instructions given for correction of motoring troubles should first be followed. If the motoring action is O. K. however, and the generator does not send charge current to the battery, about the only possible cause of trouble is in an open, shorted or grounded armature, such troubles preventing the production of any appreciable output, but rarely preventing operation as a motor. With armature trouble however the motoring action will usually be unsteady and will tend to cause a jerky action of the ammeter needle.

### Removing Motor Generator

Should it be necessary to remove the motor generator from the car, it can be done by first sliding the coupling forward on the pump shaft. This is done by knocking out the taper pin, shown in Fig. 6, and removing either of the coupling bolts. The coupling will then slide forward easily.

Referring to Fig. 4, we see the method of mounting which is by means of three cap screws, each one going through a bushing which is screwed into the crank case boss that acts as the generator support. This bushing type of mounting is for the purpose of aligning the generator, the upper one being

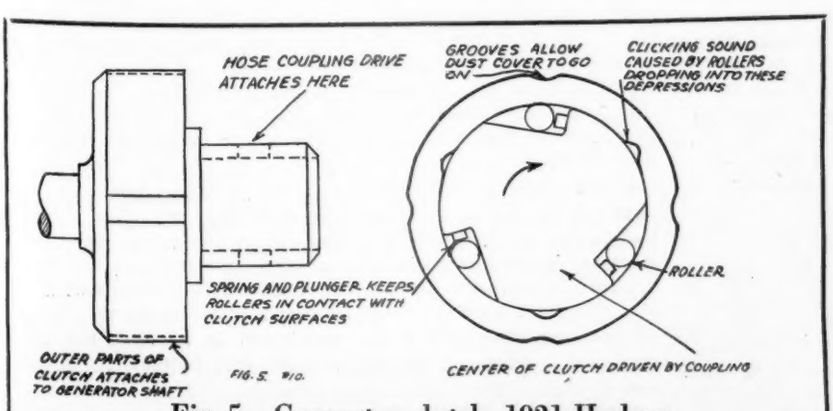



**Fig. 5—Generator clutch, 1921 Hudson**

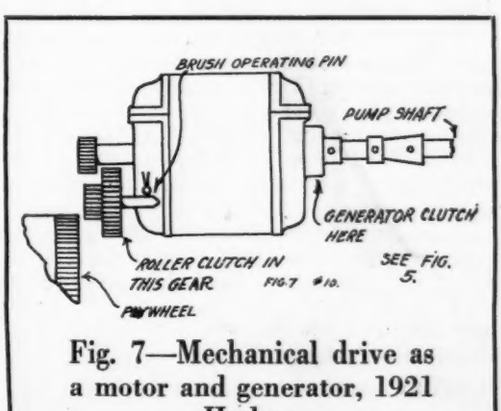



**Fig. 7—Mechanical drive as a motor and generator, 1921 Hudson**

properly set, while the lower one acts as a lock on the upper. These bushings are set properly at the factory, and under ordinary circumstances it should not be necessary to disturb their setting, as the cap screws only have to be removed to loosen and remove the generator.

**Setting Generator Output**

In order to prevent overcharging the battery at high engine speeds, the third brush method of regulation is used, the current increasing up to about 25 m. p. h. of the car and then decreasing somewhat. The maximum point of the current is adjustable by shifting the position of the third brush, but should never exceed 16 amperes.

If the output is lower than this and the battery gradually runs down, showing that a higher charge rate is required, it can be obtained by shifting the third brush in the direction of rotation. The third brush arm is really made in two parts, one being an extension of the other, and attached to it by means of two screws. These screws can be loosened and the length of the arm increased or decreased to get the necessary output. After the adjustment has been made and the screws tightened again, the brush should be fitted to the commutator by running a piece of fine sandpaper under it, the sandpaper being held tightly against the commutator with the rough side up so as to surface the brush.

LUBRICATION OF GENERATOR is required at the two oil holes, one at each end of the generator, every 300 to 500 miles, four or five drops of machine oil being sufficient.

**Lighting Circuits**

Current for the lights comes from the ammeter to the No. 1 terminal of the switch and then through the circuit breaker to the various other terminals, depending on the position of the switch handle. For example in the HEAD position, No. 7, No. 5 and No. 4 are connected which gives bright heads and tail light. In the DIM position No. 7, No. 6 and No. 4 are connected giving tail light as before but current for the head lights must go through the dimming coil on the back of the switch. Terminal No. 8 is available for parking lights or tonneau lights and is made alive by turning to the REAR position which gives a connection from No. 7 to No. 4 and No. 8. The cowl light is operated by the small button, which when turned makes a connection between No. 7 and No. 9.

THE CIRCUIT BREAKER consists of a magnetically operated vibrator through which the light current flows, the spring however being too stiff to allow operation of the contacts under ordinary circumstances. When a short or ground occurs in one of the lighting circuits however, the magnetic effect is greater than the spring and the points are pulled open. The circuit being broken, the points close again, and the action of the current again opens them. This action begins with a current of about 30 amperes, but the average value of the current while the breaker is working is much less than this. With this system, no fuses are needed, for the current even on a shorted line is held to a safe value, and the noise made also acts as a warning and tells the operator of the car that something is wrong.

**Ignition Circuits.**

When the ignition switch is turned to the ON position current is carried from the No. 1 terminal to both terminals No. 2 and No. 3, which connects the battery to the generator terminals as previously described. On the No. 3 terminal however are two wires, one going to the generator field while the other goes to the ignition coil, so that current from the battery can go through the ignition coil and on to the Ballast on the interrupter, and when the interrupter points close, the circuit is completed through them to ground. The condenser, also mounted on the interrupter serves the purpose of suddenly stopping this current when the points open, by reducing the arc at the points, and this sudden stopping of the battery current through the coil, induces the high voltage in the secondary winding which in turn causes the spark at the spark plug, the distributer carrying the connection to the proper plug. Detail of the ignition coil is shown in Fig. 8.

**Ignition Trouble**

Trouble in the ignition circuits can most easily be checked by removing the wires from the two small generator terminals, so that the only current that will show on the ammeter will be current to the coil. With the switch turned on the engine can then be cranked by hand, with someone to observe the ammeter indications. Normal action is indicated by the meter showing first a discharge of about 5 amperes, then zero, then five, then zero as the interrupter points close and open, making and breaking the circuit of the battery current through the ignition coil.

Should the current be 5 amperes all the time, it is possible that the points are not opening due possibly to wear of the fiber bumper in the interrupter. Adjustment of the points will correct this condition however.

If on the other hand the ammeter shows no reading whatever as the engine is turned over by hand, it shows an open circuit somewhere, but without testing it is not possible to say exactly the location of the trouble. One possibility is that the interrupter points are not making contact, or if they do and are badly burnt it is possible that no current is flowing due to the condition of the points.

Under these circumstances the best thing to do is to test with a six volt lamp with one end grounded and the other lead used to explore with. Connection can be made at the large generator terminal, then at the ammeter, then at the No. 1 and No. 3 terminals of the switch, then at the terminals of the ignition coil, then at the Ballast on the interrupter, and finally at the interrupter points themselves. In making this kind of a test, the trouble will be in between the last place where the lamp lights up and the first place where it fails to do so.

If the primary circuits test O. K. as above indicated, the next test should be made on the condenser. This can be done by opening the interrupter points and removing the wire from the interrupter and connecting a voltmeter between the interrupter and this wire, so that the voltmeter is in series with the circuit. With a good condenser, there will now be no reading on the voltmeter, but if the condenser is shorted, the voltmeter will show a reading, usually full battery voltage or nearly so.

With primary circuit O. K. and condenser in good condi-

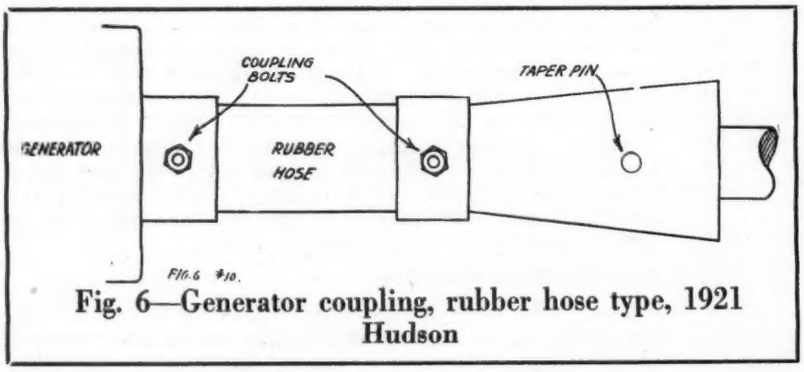



Fig. 6—Generator coupling, rubber hose type, 1921 Hudson

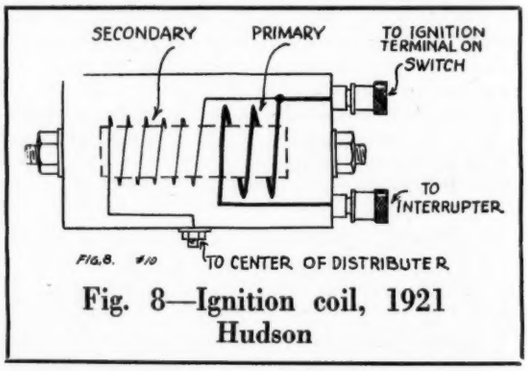



Fig. 8—Ignition coil, 1921 Hudson

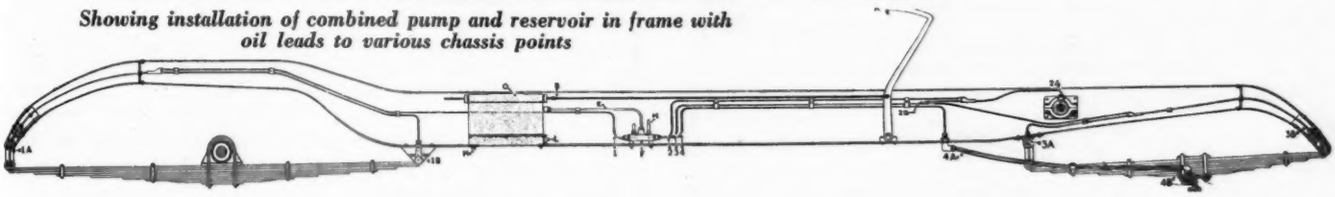
tion, failure to get a spark from the coil is due to the coil itself and a new one should be installed.

**Timing the Ignition**

This is accomplished by means of the adjustable cam in the interrupter. First however see that the interrupter points are clean and set at .018, the thickness of the gage on the distributer wrench. To set the engine in the right place, remove all of the spark plugs except the one in the No. 1 cylinder this being the one nearest the radiator. Then turn engine over by hand until the compression is felt, and then very slowly until the mark "A" on the flywheel is opposite the pointer.

At exactly this instant the interrupter points should open, which can be determined by watching the ammeter, better than by watching the points themselves. If timing is not right it can be changed by lifting the distributer brush and loosening the screw in the center of the cam. The cam can now be turned so that it is just ready to open the contacts. It will be seen that there six positions where the cam will be correct, but the one should be used that puts the distributer brush under the wire going to the No. 1 or front spark plug. After the setting is apparently O. K. the screw in the cam can again be tightened and the distributer brush replaced, but before leaving the job a final check should be made with the mark on the flywheel and the ammeter indication, to make sure that the cam did not slip when the screw was tightened, or that a mistake was not made due to back lash. In making these settings the spark lever should be in the advance position.

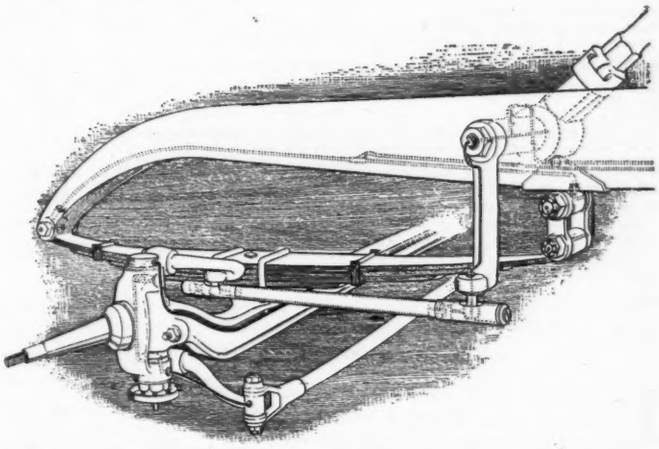
*Showing installation of combined pump and reservoir in frame with oil leads to various chassis points*



## Chalco Automatic Chassis Lubricator

THE Chalco automatic chassis lubricator manufactured by Chassis Lubricating Corp., incorporates a central tank from which oil is forced under pressure to all the chassis bearings. The system is designed to supply each bearing with oil in regulated quantities. A combined reservoir and pump is bolted to the channel frame. Pressure is obtained by means of a plunger pump accentuated by a pedal located in the driver's compartment. Control of the flow of oil is accomplished by distributing headers into which is pumped a predetermined volume of oil. These headers are supplied with four air chambers of varying area, each air chamber designed to hold the quantity of oil desired to feed a given amount of bearing space. One of these distributing headers is mounted on each side of the car and a double ended valve is located in the header closing the secondary supply line during the period pressure is exerted from the pump. This permits the air chambers to be filled. As soon as pressure from the pump ceases, the double ended valve throws over, opens up the secondary supply line and each air chamber exerts its pressure and forces its measured volume of oil through the secondary supply line into the branch supply lines which lead to the various bearings. The amount of oil supplied to each of the branch lines is controlled in proportion to the length of the bearing space supplied by the inside diameter or area of the branch supply line.

The installations vary on different makes of cars. The illustration shows the combined pump and reservoir mounted in the channel of the frame and operated by pedal. The pump forces the lubricant through the main supply line into the distributing header, which is supplied with four air chambers of a pre-determined area. The supply line from this is sent respectively to the rear part of the chassis, taking care of the left rear spring, steering gear and clutch and brake units, to the left front spring and to the king pin tie rod, etc. In this installation, a flexible tube is used for taking care of the relative motion between the front axle and the frame. The detail illustration shows how the installation is made for the steering gear parts and for the king pin at the front end of the typical car.

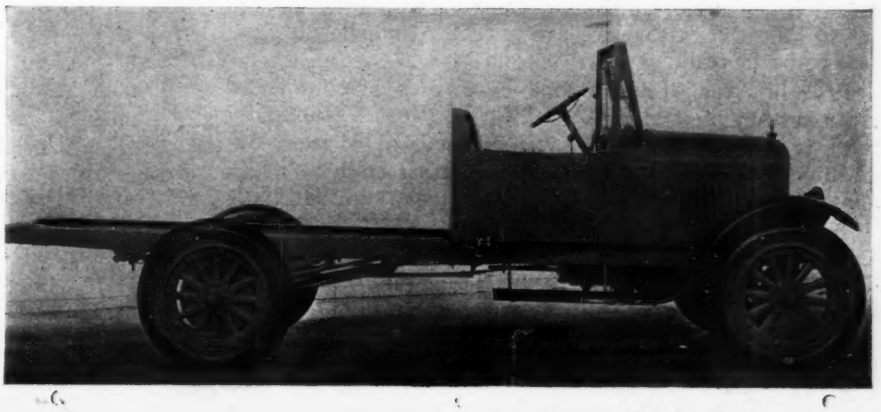


*Chalco automatic lubrication as applied to steering gears parts and king pin*

## The New Menominee "Hurryton" Truck

TO meet the demand for a high speed one-ton truck the Menominee Motor Truck Company has brought out its new "Hurryton" model. This truck was recently announced to its dealers and incorporates the following major specifications: Wheelbase 132 in., turning radius 22 ft., gear ratio 4.5-8 to 1, speed normal 35 to 38 m.p.h., chassis weight 3500 lbs. The chassis price is $1650 without cab and $1750 with cab. Tires are 34 x 5 front and rear. These being of cord construction.

The power plant comprises a Wisconsin 4 x 5 engine, three-point suspension and a three-speed gear set. The propellor shaft and universal joints are Spicer. The rear axle is a spiral gear driven Timken. Ignition is by an Eiseman high tension magneto. A 17-gallon gasoline tank is located under the front seat and the fuel is fed to the carbureter by a Stewart vacuum tank. The engine is rated at 25.6 horse power at 1400 r. p. m. and 46 horse power at 1600 r. p. m.



# MOTOR AGE

Reg. U. S. Pat. Off.
PUBLISHED EVERY THURSDAY




Vol. XLI Thursday, May 18, 1922 No. 20

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SUBSCRIPTION RATES

United States, Mexico and U. S. Possessions.....$3.00 per year
Canada ..... 5.00 per year
All Other Countries in Postal Union..... 6.00 per year
Single Copies.....35 cents

Subscriptions accepted only from the Automotive Trade

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; A. C. Pearson, Treasurer; Fritz J. Frank, Secretary.

Entered as second-class matter Sept. 19, 1899, at the post-office at Chicago, Ill., under the Act of March 3, 1879.

Member of Associated Business Papers, Inc.
Member of the Audit Bureau of Circulations.


## About Selling Goods

IT is surprising how many business people take business phrases and helpful suggestions literally. A dealer recently wrote to MOTOR AGE and asked about the "Ask 'Em to Buy" campaign. He had read of this movement and perhaps had seen the film that has been so widely shown. His trouble was that he did not sell gasoline and he wanted to know if he could use this plan in any other way than at the pump.

Perhaps some folks will smile at this man's inquiry, but there are others like it and we answer all of these questions cheerfully and as plainly as we can. That is one of the things that we are here for and, besides, we like to be helpful.

Probably very few persons have ever given all the thought they might to "Ask 'Em to Buy." Just now there is running in the advertising pages of MOTOR AGE an announcement of a window decorating contest. This announcement does not say that it is a part of the "Ask 'Em to Buy" campaign and perhaps it was not devised as such. But it is a part of this campaign, just as every other appeal to the public to examine into your goods is a part of it.

There is no direct appeal in the "Ask 'Em to Buy" film for a cleaner store, or for cleaner windows, but the lesson is so very obvious that it is reported in many towns that after this film is shown that there is a regular epidemic house cleaning. All of which is an invitation to the public to get interested. Good merchandising includes cleanliness, prompt and civil attention to customers, honest prices and so many other things that every merchant really should know without being told, that the most expert merchandiser probably never will think of all of them at one time. A wise merchant will have his wife, his sweetheart, or his most severe critic, come around to see his place at times and offer suggestions.

## Better Tractor Publicity

IF Guy H. Hall's address before the Tractor and Thresher Department of the National Association of Farm Equipment Manufacturers a few days ago rightly outlines the course of the work the National Institute of Progressive Farming, the tractor manufacturers are to be congratulated on at last joining with a proper and constructive publicity movement.

Hall, in this address, indicates that the Institute which he is promoting will be backed by pure bred cattle associations, by other societies interested in the advancement of factory farming and by the power farm implement manufacturers. The effort of the Institute will be to teach the old and young on the farms that farming can be made a safe undertaking, year in and year out, and put into a class where not all of the eggs will be in one basket. It will be the effort of the Institute to encourage diversified farming to the point where the failure of the small grain crop, or the low price of pork, will be merely an incident in the annual affairs of the farmer, not a calamity. It will also undertake to carry to the farmer the message that there are certain tools for certain jobs and that a farm home can be made just as much of a social center as a city home; that life can be made bearable by the labor helps and the comforts that do not depend upon the city central power plant.

Then, too, Hall recognizes the city farmer as a leader in farm development. Hall does not have the contempt for the big business man who buys a farm as an investment or a recreation that has so often been expressed. He says rightly that this man is often the leader in the community where his farm is located and others profit by this man's experiments.

This speech is one of the sanest arguments in behalf of farm advancement that has come to notice and dealers who are interested in farm trade would do well to pay attention to the work that is being undertaken, for it means that sales will be made for them on the right plan—that of educating the farmer to the advantages of power farming vehicles and implements.

## Whose Show Is It?

THE recent announcement of the Automotive Equipment Association that the show to be given under its auspices in the Chicago Coliseum next November would be "closed" has met with considerable opposition among Chicago manufacturers of automotive equipment who are members of the association. "Closed" as applied to this show is understood to mean that only manufacturer members will be permitted to exhibit and that only jobber members will be permitted to visit the show for the purpose of getting acquainted with the products and entering into purchasing arrangements.

The manufacturers are said to agree that only members

of the association should exhibit, but they figure that many jobbers who are not members of the association are potential customers and they would like the expense and effort they put forth in this show to reach as many worth-while distributors as possible, regardless of the membership of the distributors in any association. The jobber members of the association are said to take the position that inasmuch as they help to support the association and the non-members do not, they should enjoy exclusively the benefits to be derived from attendance at the show.

The decision to hold a "closed" show was made by the board of directors of the Automotive Equipment Association at a recent meeting at New Orleans. Both jobbers and manufacturers were represented on the board. Since then the displeasure of the manufacturer members is said to have reached such proportions that they are intent upon bringing the question up before the general session of the association at its Colorado Springs convention next month in an endeavor to have the entire membership decide whose show it is to be.

## Can You Afford to Be Without— *Portable Work Benches?*

A SERVICE department executive at one time said in making an analysis of his business that apparently a good many of the mechanics in the shop were being paid for walking instead of working. In other words too much time was consumed in going to and from the car or engine to some part of the shop for tools, parts, etc.,

The economic arrangement of a shop demands that the workman be kept as close to the job on which he is working as possible at all times, if we are to accept what the exponents of the time and motion study subject tell us. No doubt a certain amount of time is lost in every shop by a mechanic which must be charged to the job on which he is working, which means that eventually the customer pays for a certain amount of unproductive labor.

The man working at the bench probably does not waste as much time as the man who is working on a car or truck in a part of the shop many steps away from the bench. Unless such a man has organized himself for each job he is going to tackle, he will spend a certain amount of time in going to some other part of the shop for bench work to hold a part in the vise, to get bolts or cotter pins from the parts department, etc. It is for this class of workman that the portable work bench is especially desirable.

The portable work bench lends itself admirably to shops doing a variety of work. With a portable bench equipped with vise, tools and parts trays, etc., you bring shop facilities to the car or truck no matter where it is located in the building. Also, should it be deemed necessary at times to perform service operations in a yard adjacent to the building the portable bench readily can be moved to the scene of action.

In most shops it is customary to run a bench the entire length of one wall. This, of course, is desirable in institutions where the shop is pretty well departmentized and certain classes of work performed at certain sections of the bench. Even so, there are times when a bench or the space around it becomes congested with workmen and it is under such conditions that the portable bench meets with approval. In such shops where great volumes of work are handled, portable work benches have been found very satisfactory. Those who have used these benches claim they are far superior to confining all the activities of the shop to one long wall bench. Each service executive or shop foreman must necessarily decide whether or not portable benches are suited to conditions. Certainly if analysis shows that mechanics are taking many unnecessary steps in carrying out their work it would seem desirable to not try to get along any longer without this important piece of shop furniture.

## Racing and the Car You Sell

TO many an event like the 500-mile Indianapolis race to be run May 30 is but a great sporting spectacle, where the knights of the gasoline circuit fight for premier honors. In the main this is true. It is like a baseball game, horse race or a three-ring circus. It furnishes entertainment for the multitude. It means the making of a fortune for some and financial loss to others. The drivers attain glory and the mechanics get a sideache. And so on.

There is another side to automobile racing, however, which many a spectator never considers, and that is the lessons which are learned by those who have spent vast sums of money in building the cars and who, directly or indirectly, contribute what they have learned to the fund of knowledge regarding automotive engineering.

Automobile racing has been directly responsible for the success of many designs and constructions used in the present-day passenger car, truck or any other automotive vehicle. Engines which go through a race like that at Indianapolis endure as much stress and strain as the ordinary passenger car engine in the life of the vehicle. This is due to the intense conditions under which they operate.

We have better steels and alloy metals today because of what engineers, have learned from racing. Our engines are more efficient; will perform over long periods much better and retain more even operating temperatures, because of many lessons taught by racing.

Lives have been lost in past years in the great outdoor laboratory of racing because parts crystalized and broke, but today it is rare that a car goes out because of a broken steering knuckle, or some equally important unit. We have learned to make better steels and we have developed better heat treatments of steel. All of this has been reflected in the design and construction of cars which dealers are selling to their customers. Not so long ago speeds of 75 and 80 m. p. h. on the speedways were considered quite out of the ordinary for racing cars but today we have stock passenger cars capable of this speed. But beyond developing high maximum speed, racing has helped to make the cars more sturdy and lighter weight. Where years ago we used heavy and bulky parts to get strength, today we use very light parts but parts which are amply strong, all because racing has taught us much. What you see on the race track today, you will see tomorrow in the automobile you are selling.

### A PROFITABLE LOSS

A BOSTON distributor who sold 364 automobiles last month had to do porter work for a Cleveland distributor who sold 490, the latter having been challenged to a contest by the Boston man. The menial labor of this high priced porter was celebrated with a banquet and a band, and no doubt other dealers would welcome a day of sweeping-up under the same conditions.

# Production Continues to Increase

## May Output Expected to Exceed That of Last Month

### Orders in Hand Indicate Some Factories Will Run at Capacity All Year

NEW YORK, May 16.—Reports from dealers in all parts of the country show that no sign of slackening in the demand for motor vehicles is apparent. Producers are exerting every effort to turn out this month more cars and trucks than were made in April. In most cases output will be circumscribed only by plant facilities. Total production for May is almost certain to exceed the high mark set last month.

While it still seems likely that there will be a decline of sales in the third quarter, the impression is gaining ground that some companies will find business so good they will be able to operate their factories practically at capacity the entire year. Each manufacturer hopes he will be able to keep in this class.

**General Motors Corp. expects the third quarter to be better than the second in the sale of its three most popular lines. Henry Ford finds the outlook so encouraging that he has abandoned certain plans he had in mind early in the year for using surplus factory space. He has no surplus space now and there are no indications that any will be available this year.**

One striking feature in connection with the extraordinary sales of motor vehicles in this country has been the almost simultaneous increase in foreign demand. Ford's foreign assembling plants are establishing new records and General Motors reports large gains in sales, especially in Great Britain. Demand is also much better in Brazil, Argentina, Spain, Denmark, France and other countries.

Output of enclosed passenger cars still is handicapped by a body shortage, although body makers are resorting to all kinds of expedients to enlarge their production. One of their serious difficulties is the shortage of skilled labor. An other influx of workers is under way at Detroit, although there is plenty of unskilled help.

Cars of the enclosed body type are in greater demand this year than ever before. In some cases it is 50 per cent of the output. The new type of soft top, glass enclosed vehicle is most popular. This is the result of materially lower prices in comparison with the former cost of enclosed models.

Except for the body situation, the parts shortage is not so serious as it was last month, because parts manufacturers have been speeding up production. Collections are highly satisfactory and all but a comparatively small percentage of bills are being paid when due.

Factories turning out the more popular lines of passenger cars have enough orders booked to keep production at the present pace for several weeks. Distributors in agricultural districts are placing orders for July 1 delivery to take care of demand from farmers, which is expected to show a sharp increase at that time.

## Sells Automobile by Radio

*TOLEDO, O., May 16.—The sale of an automobile by radio is reported by Leo Nachtrab, salesman for the Willys-Overland branch here. The sale was to Charles R. Thorpe, secretary of the William B. Duck Radio Co.*

*The Willys-Overland branch has a radio receiving set with which concerts are given each evening in the salesroom. One evening the Willys-Overland set was tuned in with the Duck sending station and Thorpe called Nachtrab's name and gave him instructions for delivering the new car. Thorpe is now driving the new car.*

### CULVER SUCCEEDS COLBURN

St. Louis, May 13—Webster Colburn, who since January, 1918, has been vice-president and general manager of the Dorris Motor Car Co., resigned both positions with that company, effective May 1. Colburn will become secretary and treasurer of the fiscal agency of the American Union Housing Trust.

Nineteen years ago, Colburn went with the St. Louis Motor Carriage Co., which had been organized by George P. Dorris to build motor cars, then in crude development. In August, 1905, he with Dorris and others organized the Dorris Motor Car Co. and began the manufacturer of the Dorris car. Colburn announced that he would remain as a director of the Dorris Motor Car Co. J. F. Culver, for some time secretary and treasurer of the Dorris company, was elected general manager to succeed Colburn.

### M. A. M. A. SURVEY

New York, May 13—The Motor Accessory Manufacturers' Assn. has issued a survey showing a sharp increase in the business of accessory and parts manufacturers for the first three months of this year.

The survey shows that past due accounts reported by parts and equipment makers decreased more than eight per cent in February and approximately 28 per cent in March. There was a decrease of 23 per cent in notes outstanding in March.

## Credit Improving Rapidly in Automotive Industry

### Much of Current Business Paid for When Due—Some Companies Taking Discounts

NEW YORK, May 16.—Credit conditions in the automotive industry are steadily improving. Parts manufacturers report that they are being asked to accept notes only by a comparatively few companies which have been in financial difficulties for months and have not obtained additional financing.

Vehicle manufacturers who are producing on a large scale are rapidly wiping out their past-due notes and many of them already have cleared their books. All but a comparatively small percentage of the current business is being paid for when due and some companies are discounting their bills.

There has been a steady whittling down of past-due accounts for the past three months and continued progress in this direction is being made except by the companies which have been unable because of lack of working capital, to take advantage of the present extraordinary demand for cars and trucks.

The rapid improvement in collections has made it possible for the parts makers to liquidate a large part of their own indebtedness and their position in this respect is much stronger than at the beginning of the year. They also are able to pay their bills when due.

### JUMBO TRUCKS REDUCED

Saginaw, Mich., May 13—The Nelson Motor Truck Co. has reduced the prices on its entire line of Jumbo trucks. The list follows:

| | Old Price | New Price |
|---|---|---|
| Jumbo 15 | $2425 | $2295 |
| Jumbo 20 | 2675 | 2520 |
| Jumbo 25 | 3090 | 2660 |
| Jumbo 30 | 3590 | 3060 |
| Jumbo 35 | 4080 | 3900 |
| Jumbo 40 | 4730 | 4400 |

### LIBERTY'S BEST MONTH

Detroit, May 15—The Liberty Motor Car Co. announces that its May production will exceed that of April, which was the best month in its history. Dealers in 18 states including Ohio, Illinois, Pennsylvania, New York, Michigan, Rhode Island and Massachusetts, delivered more Liberty cars in April than in any previous month.

### HANSON INCREASES OUTPUT

Atlanta, Ga., May 16—Production of the Hanson Motor Co. has been increased to 10 cars a day for May. The average was five a day in April. New agencies recently opened include New Orleans, Pittsburgh, Milwaukee, Cincinnati and Knoxville.

# Tire Production Nears Peak

## Merger of Pierce-Arrow and Lafayette Abandoned

### Negotiations Dropped Suddenly With Statement Terms Could Not Be Agreed Upon

NEW YORK, May 15—Announcement is made by the banking house of J. & W. Seligman & Co. that negotiations for the consolidation of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. have been abandoned because of inability to agree upon terms. No further explanation has been given up to this time, although Col. Charles Clifton, chairman of the board of the Pierce-Arrow company, said in Buffalo that a statement of the reasons would be given out in New York by committees representing both boards of directors.

Announcement that negotiations were off came as a complete surprise because it had been understood only a few legal difficulties based upon the fact that the companies were incorporated in different states, stood in the way of their completion.

Under the consolidation plan, C. W. Nash, president of the Lafayette company and of Nash Motors was to be in charge of operations as chairman of the board of the consolidated companies while Col. Clifton was to serve as president. The only explanation ever offered for the proposal to unite the two companies was that some of the surplus factory space of Pierce-Arrow could be used to build bodies for the Lafayette. It was stated that both cars would be continued as at present.

### DU PONT IN DANIELS CO.

New York, May 13—Announcement is made by Gillespie Meeds & Co. who are forming a syndicate to underwrite the sale of $1,000,000 of 8 per cent preferred stock of the Daniels Motor Co. of Reading, Pa. that Paul duPont of Wilmington, Del., president of duPont Motors, Inc., and his associates have become actively identified with the Daniels company. It is stated that duPont has taken a substantial financial interest in the company. L. I. Gillespie and H. A. Mansfield have been added to the board of directors of the Daniels Company.

### BUICK IN "DOUBLE PLAY"

San Francisco, May 13—The Buick automobile figured in a "double play" on the Pacific coast, on May 2, when Mrs. C. K. Ayers of San Francisco, checked in at Portland in her 1922 Buick four-cylinder coupe, after cutting nearly six hours off the railroad time between here and the Oregon city. Mrs. Ayers drove the 725 miles in 22 hours, 43 minutes, including 35 minutes on the ferry crossing San Francisco Bay from San Francisco to Oakland. This compares with 28 hours, 30 minutes, the fastest schedule of the best passenger train between the two cities.

On the same day, a 1922, four-cylinder, model 35, five-passenger Buick arrived at Camp Curry, the first car of the year to be driven into the Yosemite Valley. In the car were Fred E. Gross, Arthur Turnbull, Dell Walsh and Ed Rogers, of the Howard Automobile Co., of San Francisco, Buick distributors for this section. They won the Camp Curry trophy, annually awarded to the first car into the valley.

### "FORD DAY" AT SEDALIA, MO.

Sedalia, Mo., May 15—"Ford Day" is to be celebrated in Sedalia on Saturday, May 20. The Chamber of Commerce and numerous business men are arranging a list of contests and prizes.

"Flivvers" old and new, dilapidated and in the best of running trim, all being able to go "on their own legs," will make up a show equal in many respects to a circus, the promoters of the project assert.

Awards will be offered for the Ford coming the longest distance; best decorated; one hauling greatest number of persons; Ford driven by oldest man and oldest woman; Ford having covered greatest number of miles during its "life" and other classifications.

### PARIS SHOW SPACE

Paris, May 8—Requests for space in the Paris automobile show, to be held in the Grand Palais from Oct. 4 to 14 inclusive. will not be received later than May 24. The French show is closed to ex-enemy nations; Allied manufacturers are placed on an equality with French firms with the exception of America makers, who are only admitted after other requirements have been met.

### DETROIT PAYROLLS INCREASE

Detroit, May 15—A further increase of 3,683 employes, making a new high total of 158,889 on the payrolls of the members of the Employers Assn., was reported for the week ending May 13. This is 40,000 above the corresponding week last year and only 30,000 less than for the corresponding week of 1920.

### TWIN CITY TRACTOR REDUCED

Minneapolis, May 15—The Minneapolis Steel & Machinery Co. has reduced the price of its 20-35 Twin City tractor from $2950 to $2750.

### TIRE PRICES REDUCED

Pottstown, Pa., May 16—The Hydro United Tire Co. announces a reduction of 20 per cent on all Ford size Hydro Toron tires and 10 per cent on other sizes.

## Akron Plants Operating at 85 Per Cent of Capacity

### Shortage of Skilled Workers Hampers Efforts to Increase Output Quickly

AKRON, O., May 16—Akron tire factories are finding it difficult to meet the current demand for tires. Plainly the demand has been underestimated not alone by tire manufacturers, but by car manufacturers and tire dealers. A policy of ultra-caution in ordering stocks and in getting a quicker turnover of stocks on dealers' shelves, has brought the tire industry to the verge of an absolute tire shortage unless there is a slight let-up in the demand of sufficient duration to permit manufacturers to catch up.

Tire production in Akron now exceeds 85,000 casings a day. The same companies reporting this aggregate output, showed a combined peak production during the abnormal season of early 1920, of slightly over 101,000 tires a day. These figures show that output now is 85 per cent of peak and far ahead of normal tire production, for normal is based at 75 per cent of peak.

Numerous companies are producing above the old 1920 peak marks. This is more particularly true of the smaller companies. The larger companies are operating three eight hour shifts daily and have exhausted the available supply of experienced tire builders. They have sent out urgent appeals for tire men, seeking to recall former employes who now are employed elsewhere.

How long the current spurt will last, no one will venture a prediction although most manufacturers are confident that it will continue for some time and have given reasonable assurance of steady employment at least until Aug. 1, to the hundreds of men taken on since April 1. There are a few exceptions however, with some manufacturers feeling that June will bring a seasonal slump in tire sales. These men still advise a policy of caution and warn against too swift a pace which will result in an overproduction.

The Goodyear Tire & Rubber Co., as compared to a peak production obtained in 1920 of 31,000, casings a day, now reported a production of 26,000 tires daily and is still putting on men. Goodyear has jumped from about 20,000 tires at the first of April. Firestone is running proportionately closer to its old peak record of 28,500 casings a day with a present output of 25,000 daily. The B. F. Goodrich Co., reports considerable sales improvement through the introduction of new tire lines and is producing about 16,000 daily as compared to a peak of 26,000. The Miller Rubber Co. is strain-

## Ford Preparing to Make 150,000 Vehicles in June

### Sales of Cars and Trucks in April Reached New Record of 127,249

DETROIT, May 17—April sales of Ford cars and trucks in both the United States and foreign countries totaled 127,249, according to the revised figures just announced by the company.

This exceeded the schedule of 120,000 fixed by the company as the April figure and indicates an unexpectedly increased demand in foreign business rather than in sales within the United States. The previous high record for one month made in June, 1921, was exceeded by 15,467.

**The May figure has been fixed at 135,000 and preparations are already being made in the purchasing department of the company to provide for an output of 150,000 in June. Even with an output of 135,000 in May there will be approximately 30,000 orders carried over into June.**

Daily average sales in the United States reached a total of 5210 at the end of April. Production for the year is expected to reach 1,100,000, a gain of 10 per cent over 1921.

Fordson tractor sales in April totaled 11,181, a daily average of 469 being reached by the end of the month. This is a new high sales record for tractors and shows a gain of 100 per cent over the best month of 1921. Truck production and sales approximate 10 per cent of the Ford business, giving an approximate sale in April of 12,725 trucks.

#### WESTCOTT PRICES REDUCED

Springfield, O., May 16—Reductions in prices of Westcott automobiles effective at once were announced May 13 by the Westcott Motor Car Co. The new list follows:

| | Old Price | New Price |
|---|---|---|
| A-44 Standard phaeton | $1890 | $1690 |
| A-44 Special phaeton | 2190 | 1890 |
| A-44 Special sedan | 2890 | 2690 |
| C-48 phaeton | 2090 | 1890 |
| C-48 sedan | 3490 | 2890 |
| C-48 Limousine-sedan | 3690 | 3090 |

#### TIRE PRODUCTION NEARS PEAK

(Continued from preceding page)

ing its plant to the utmost, producing 6,500 a day as against a peak of 6,000. Miller recently has acquired 100,000 square feet of storage space near its factory and will use it for stock supplies so as to free factory space for installation of new equipment in order to increase production.

The smaller tire companies all are booming. Mason at Kent, near Akron, is running 3,500 casings a day as against a peak of 2500. General of Akron has passed its old peak of 1200 daily and is averaging over 2000 a day. Kelly-Springfield's Akron plant is back to the old top record of 1,600 casings. Mohawk is producing 800, and Swinehart 750. Each of these companies had a peak of 1000. India is above its old high watermark of 500 and reports an output now of 700 a day. The American Tire & Rubber has climbed back to its highest production mark of 750 daily.

The Seiberling Rubber Co. is producing over 1200 cords a day at its Barberton plant and over 800 Portage fabric tires at New Castle, Pa.

## Stewart Warner Doubles Force; May Best Month

Chicago, May 16—The great activity of automobile manufacturers is strikingly reflected at the plant here of the Stewart-Warner Speedometer Corp. which manufactures speedometers, vacuum tanks and a number of other products used as factory equipment on many automobiles.

The Stewart-Warner plant is working at high speed and increasing its ouput as rapidly as new employes can be absorbed. Since early in the year the number of employes has been doubled and is now in excess of 2,000.

The sales of the company for the first week in May came within a few dollars of being twice as much as the sales for the corresponding week last year. Officials of the company state that the orders now on hand and the increased factory output indicates that the money value of this month's business will be the greatest of any month in the company's history. The corresponding high month was May of 1920.

#### FORD BUYS KILN EQUIPMENT

Indianapolis, May 15—The Ford Motor Co. has placed an order for 66 carloads of dry kiln equipment with value in excess of $200,000, with the National Dry Kiln Co. of this city. The order, said to be one of the largest single orders for kiln equipment ever placed, is to be shipped to the Iron Mountain plant of the Ford Motor Co.

#### TO INVESTIGATE GASOLINE PRICE

Washington, May 16—The Department of Justice has ordered its agents in a number of the larger cities to investigate recent increases in the price of gasoline.

## Bloomington Dealers Modify Used Car Depreciation Plan

### Will Have Committee of Appraisers Fix Valuations in Unusual Cases

BLOOMINGTON, Ill., May 16—After handling used cars for two months under an agreement which carried a fixed standard of depreciation, the Bloomington Automobile Assn. has gone a step farther and will now try out the committee appraisal system. After the thorough trial of the annual depreciation system, it has been found that this is susceptible to improvement, due to the varying condition of cars of the same make and age.

The first agreement made money for the dealers, as it brought down the prices which had previously been allowed for used cars and also abolished the former practice of dealers bidding against each other for the privilege of paying a fancy price for an old car in order to sell a new one.

It is now proposed to appoint two dealers in used cars who have had long experience, as appraisers, and, in case these two can not agree upon the value, they are to call in a third and the opinion of the majority will be final. No dealer will be expected to offer more than the price fixed by the appraisers.

It has developed of late that there are instances where a car is offered which has been kept in first class condition and has never been abused and, therefore, is worth more than the depreciation plan allowed.

The dealer who swings the trade by which a used car is taken will pay the appraisers, while the latter agree to take such cars from the dealers at the price allowed, thus giving the dealer his full profit for a new car. The Bloomington association was unable to secure the endorsement of all the dealers to the first agreement, two refusing to sign, but the appraisal system, has brought all of them in line.

## A Novel Tire Demonstration


A clever plan for advertising its puncture-proof tires is in use by the Lee Tire Sales Co., of Washington, D. C. Their exhibit at the Washington Show consisted of several Lee-equipped cars and trucks which stood on literal beds of thorns, formed by blocks of wood from which several hundred sharp nails projected upward. This idea is now being repeated with success upon the streets of the Capitol, the car being parked for a half hour in busy sections of the city, and literature distributed to the crowd which collects.

The unusual demonstration is attracting much attention.

## Hearing Held on Federal Registration and Tax Bill

### Former President of A. A. A. Denounces Measure Which Would Increase Cost of Automobiles

WASHINGTON, May 16—Characterizing as a "monstrosity" the Mills bill providing for a $2 Federal registration tax on all automobiles, Dr. H. M. Rowe, former President of the American Automobile Assn., denounced the measure and declared it was impracticable. Much additional opposition to the measure was also voiced before the House Ways and Means Committee which held its first hearing on the measure Friday by other witnesses. Melvin P. Bender, attorney for the New York Automobile Federation, declared that the measure would cost American motorists an average of $22 in time and money.

If the bill is passed, it was shown at the hearing, automobile manufacturers will be charged with the duty of stamping on each body and each engine a serial number. For this, it was contended, there must be a charge and consequently an increase in price. In the changing from winter to summer bodies, the owner of an automobile, under the provisions of the bill, must get a special title for the new body not stamped.

American motorists at the present time are paying $344,000,000 Federal and state taxes, the figures presented showed. Under the Mills bill it is expected that the $2 tax would bring in $26,000,000 a year and would mean the creation of thousands of new Federal jobs, it was charged by Dr. Rowe.

Hiram Todd, United States District Attorney for Northern District of New York, appeared in favor of the bill, contending it would prevent the theft of cars, would reduce insurance and that the bill had the approval of the Treasury and Justice Departments.

As a result of the protest made by 340 active clubs the A. A. A., representing 500,000 members, the following report was filed with the committee opposing the measure:

"Motor cars are today taxed directly from six to eight different times, and now comes the proposition of a federal tax, which will necessitate miscellaneous charges for registering and re-registering, which in all would substantially make it a tax of over $30,000,000 a year.

"It is impracticable from the standpoint of affixing a 'permanent' number to the parts of an automobile. Should such a number be affixed, once, the constant necessities of the motor car industry are such that in the repair of cars, it would place on the industry an unwarranted burden.

"The federal government should not set up the principle of making abstracts of title for automobiles any more than they should for realty. The benefits to be derived are not in keeping with the expense of the undertaking."

An opinion was expressed to the committee by Dr. Rowe, that the measure if passed, would be illegal. "I seriously doubt the constitutionality of such a bill as the Mills' measure, as it certainly is a usurpation of the authority of the states and is not an inherent right of the federal government."

## Sells 364 Cars in Month; Loses to Seller of 490

*CLEVELAND, May 13—When Joseph Donovan, Studebaker distributor in Boston came here last week to do porter work for Edward Murnane, Cleveland distributor for Studebaker, there was a quite a celebration, with a band and a speech by A. R. Erskine, president of the Studebaker Corp. The band played while Donovan used the broom vigorously and gave the local Studebaker salesrooms a thorough cleaning.*

*Donovan used to think he was the best distributor Studebaker had. Murnane held a similar opinion regarding himself. The two men got to boasting and then there was a challenge. A sales contest was arranged for the month of April and it was agreed that the loser should act as porter for one day for the winner. When the month ended Donovan had sold 364 Studebakers and Murnane had sold 490. Donovan came here to do his porter work, but was met at the station by a band and the president of the company. That night he was entertained at a dinner at which President Erskine made a speech congratulating both distributors.*

### CONTINUED TIRE SALES

Chicago, May 13—Continuation of good business in the tire industry was reported by members of the Midwest Rubber Manufacturers' Assn., who attended the association's monthly meeting here this week. Representatives of tire fabric producers said there is a very heavy demand for their product and that there are indications of an increase in the price of cotton, which would have to be passed on in the price of tires.

### SUNDAY CLOSING POLICY

San Francisco, Cal., May 15—Strict enforcement of the Sunday-closing policy of the San Francisco Motor Car Dealers' Assn., was agreed upon at a meeting of virtually the entire membership the last week in April. Closing of all show and salesrooms of all members all day every Sunday became effective at once.

### WESTCOTT'S BIGGEST WEEK

Springfield, O., May 10—Last week was the largest week in shipments of cars that The Westcott Motor Car Co. has enjoyed for several years. Fifty-five machines were shipped and a number of others were driven away. These went to Cleveland, Columbia, Cincinnati, Pittsburgh, Chicago and Indianapolis.

## Improvement Continues in Farm Equipment Business

### Tractor Makers Optimistic About Remaining Months of Year—Buying Increases

CHICAGO, May 15—Continued improvement in the farm equipment industry during March and April is reported in the May bulletin of the National Association of Farm Equipment Manufacturers. In a trade review based on reports received up to the middle of April, the bulletin says:

"There seems to be a better tone evident than was the case a few months ago, and even those companies whose shipments thus far in 1922 do not equal those of the corresponding period last year find cause to anticipate a greater volume of business during the remaining months of 1922 than they experienced during the same months in 1921.

"This belief is based upon many factors, among them being the changed attitude of the farmer; his pressing need for equipment, due to curtailed purchases in the past; increased prices received for farm products, and reduced prices of farm equipment."

The review states that most of the new business is being paid for promptly many dealers taking advantage of cash discounts. Collections on old accounts are said to be slow.

With few exceptions, the review states, the tractor and threshing machine business was less in the early spring months than in the corresponding months of last year. Only one manufacturer reported production at normal. Others were operating at from 10 to 60 per cent of normal. The tractor makers expressed confidence in the continued improvement of tractor sales as the season advances.

### COATS STEAMER GETS FACTORY

Chicago, May 15—The Coats Steam Car Co. announces that the F. Y. Stewart Mfg. Co., of Bowling Green, O., has acquired the factory of the Buckeye Body Co., at Columbus, O., and will manufacture the bodies for Stewart-Coats steam cars and assemble the cars in that factory. The engines and boilers are being manufactured in the Stewart plant at Bowling Green. The Columbus factory is said to have a capacity of 35 cars a day. The general sales offices of the Coats company will be maintained in Chicago.

### MAY REDUCE GASOLINE TAX

Baton Rouge, La., May 15—That there will be no upward movement and there may be a downward movement in the road tax on gasoline and the automobile, truck and motorcycle license taxes is the general indication at the opening of the biennial session of the Lousiana legislature. The protests against the present taxes have been long, loud and bitter.

## Dealers at Jacksonville, Ill., to Have Show Building

### $1000 Profit from Recent Exhibit to Go for Stock in Public Structure

JACKSONVILLE, ILL., May 13—After paying all bills, the Jacksonville Automotive Dealers Assn., reported a surplus of $1,000 as the result of the March display of cars and accessories. This money will be placed at interest until the question of erecting a public building is settled. This structure, which is badly needed here for large gatherings, will be utilized by the motor car dealers for their annual show. Should the business men decide to erect such a building, the automotive dealers will invest the balance remaining from the recent show, in building stock. In addition a number of the automotive dealers will subscribe $1,000 each, being confident that such a structure would prove profitable and a paying investment for those who take care of the financing. In addition to the sum of $1,000 which stands in the treasury, the dealers here voted $150 of the profits to local charities. It was felt that as the public had liberally patronized the automobile show that it was fitting to turn back some of the profits to the hospitals and other institutions of a public nature. The Jacksonville association has steadily increased in membership, there is a large attendance at the meetings and the organization compares favorable with the most successful in the state. Much of the credit for the success of the organization is due to the president, J. G. Berger.

#### 95½ MILES ON GALLON

Paris, May 8—A distance of 123.2 miles was covered by a 45 cu. in. two-seater Peugeot light car on a can of gasoline containing 1.29 gallons. This is equivalent to 95½ miles per American gallon. The performance was made in open competition at Le Mans over ordinary roads, each of the competitors being given a can of gasoline, and the winner being the one covering the greatest distance. The winning Peugeot, driven by Gremillon, was followed by Henry Petit on a similar Peugeot who covered a distance of 115 miles before coming to a stop. The third machine home, also a Peugeot, was driven by Madame Lavie, and covered 95 miles. The first three machines were fitted with Zenith carbureters.

#### CAN'T MAKE DELIVERIES

Milwaukee, Wis., May 15—It is almost unbelievable to the average person that the call for passenger cars should in the short space of about three months reach the comparative tremendous extent that is now just becoming strongly noticeable. The demand is such that many dealers in Milwaukee are no longer able to make immediate deliveries of open cars, while coupe and sedan types generally are not available for periods ranging from 10 to 40 days.

Dealers for the first time in about two years are experiencing the sensation of being afraid of losing orders for new cars in favor of dealers who are able to make earlier deliveries, when prospects refuse to wait and declare they will buy a car which they are able to get right away. Retail business from April 15 to date is reported to represent the largest total for any corresponding period in the history of the trade, save that in 1919.

## Good Prices Received for Used Cars at Chicago Show

Chicago, May 12—The following are some of the prices received for used cars at the Used Car Show held by the Chicago Automobile Trade Assn.:

| Year | Name | Type | Price |
|---|---|---|---|
| 1919 | Cole | Sedan | $2250 |
| 1921 | Franklin | Phaeton | 1300 |
| 1919 | Paige | Phaeton | 800 |
| 1920 | Cole | Phaeton | 1250 |
| 1918 | Apperson | Phaeton | 1000 |
| 1920 | Buick | Phaeton | 800 |
| 1920 | Jackson | Phaeton | 800 |
| 1920 | Velie | Phaeton | 750 |
| 1916 | Velie | Phaeton | 425 |
| 1920 | Maxwell | Phaeton | 300 |
| 1921 | Dodge | Phaeton | 875 |
| 1920 | Dodge | Sedan | 1195 |
| 1919 | Studebaker | Phaeton | 900 |
| 1919 | Buick | Phaeton | 750 |
| 1920 | Jackson | Phaeton | 700 |
| 1920 | Chandler | Dispatch | 800 |
| 1919 | Cleveland | Phaeton | 825 |
| 1920 | Reo | Phaeton | 875 |
| 1921 | Marmon | Phaeton | 2500 |
| 1917 | Oakland | Phaeton | 600 |
| 1917 | Kissel | Sedan | 450 |
| 1920 | Studebaker | Phaeton | 895 |
| 1920 | Oakland | Phaeton | 600 |
| 1920 | Paige | Phaeton | 850 |

#### TRAFFIC PROBLEMS CONFERENCE

New York, May 15—Means of solving some of the truck traffic problems, such as overloading and overspeeding, will be considered at a conference late this month of the motor vehicle commissioners of all the New England states, New York, New Jersey, Pennsylvania and Maryland with a special committee of the National Automobile Chamber of Commerce composed of R. H. Salmons of the Selden Motor Truck Co., R. O. Patton of the Pierce-Arrow Motor Car Co., D. C. Fenner of the Autocar Co., F. W. Fenn, secretary of the motor truck committee, and Harry Meixell, secretary of the motor vehicle conference committee.

#### LA SALLE DEALERS ELECT

La Salle, Ill., May 15—In a meeting held at the Kaskaskia Hotel dealers in automobiles and kindred lines organized the La Salle County Automotive Trade Assn. and elected the following officers: President, John S. Goebel, Mendota; Vice-President, Matt. H. Knauf, Peru; Secretary, Harry Fahler, Mendota; Treasurer, E. L. Williams, Ottawa; Directors: H. Meyers, Jr., Mendota; J. E. Seepe, Peru; D. M. Silkworth, La Salle.

## Crop Prospects Cheer South But Floods Hinder Sales

### Increased Prices for Sugar and Lumber Help Business in Louisiana

NEW ORLEANS, May 15—Loss of a large amount of crops and property due to floods from the record high water in the Mississippi is reported to have spoiled the plans of a business man of Natchez, Miss., to gather in a number of used cars in New Orleans and sell them in the smaller towns of Louisiana to planters whose prospects for exceptionally profitable crops were excellent. The number of cars sold in the sugar and rice sections this winter was larger than expected, but an unusually high proportion was used cars. Dealers in Lake Charles, the largest town in southwestern Louisiana, bought used cars in New Orleans to sell to rice farmers, who are familiar with gas engines through years of use of tractors. The prospect of good crops and high prices for sugar and rice and the fact that practically all the lumber mills are running full time, and some extra time, with orders reported by the Southern Pine Association at 20 per cent above normal, is doing a little in New Orleans to cheer up what would otherwise be a gloomy summer.

#### AUTOMOTIVE MEN CANDIDATES

New York, May 13—Two representatives of the automotive industry have been nominated for directors of the Chamber of Commerce of the United States. They are W. O. Rutherford, vice-president of the B. F. Goodrich Co., who is a candidate from the domestic distribution group, and C. F. Kettering, president of the General Motors Research Corp., who was nominated to represent the sixth district composed of Ohio, Indiana, Illinois, Michigan and Wisconsin. The directors will be elected by the National Councillors who will meet in the Washington Hotel at Washington, May 15.

#### NEW A. E. A. FILM

Chicago, May 13—The filming of the Automotive Equipment Assn.'s second moving picture for use in its merchandising campaign is progressing under the direction of Ray W. Sherman, merchandising director of the association. The film will be entitled, "Shop Profits," and its object will be to show how the shop proprietor may make a greater profit from his business.

#### OFFICERS AT CHARLOTTE

Charlotte, N. C., May 13.—Lane Etheredge was elected president of the Charlotte Automotive Trade Assn. at the annual meetting of the association held this week. Thomas Glasgow was chosen vice-president and Miss Frances Herndon secretary and treasurer.

## Colorado Decision Checks Use of Highways by Trucks

### Utilities Commission Holds That Without Adequate Taxation Traffic Is Not Permissible

DENVER, May 15—The railroads of Colorado have won an important victory in their campaign against the operators of motor trucks who have taken away from the carriers a large share of the short haul freight traffic. This anti-motor truck campaign has resulted in a decision by the Public Utilities Commission of Colorado that the truck operator is not entitled to the use of state highways until the taxing laws are so amended that he "shall contribute his due proportion to the cost of construction and maintenance of the highways."

The commission asserts that an investigation it made of the transportation conditions in Eagle and Garfield counties showed that although there were 68 motor trucks operating as public carriers they paid into the state treasury only $819 a year while the Denver & Rio Grande Western Railroad, which these buses parallel, paid during the same period $38,023 for the public roads which they do not use at all and additional taxes bringing the total paid by the railroad company up to $153,896.

The section of the decision defining "public convenience and necessity" follows:—

"Public convenience and necessity, by which must be understood the convenience and necessity of the people at large as contradistinguished from the convenience and necessity of a very small number of persons who seek to derive a profit from the farmers' and home owners' investment in roads, never contemplated that the truck driver should destroy that, to the cost of construction of which he contributed little or nothing, or that he should reap where he has not sown. When the taxing laws of this state are so amended that the truck driver operating over state highways shall contribute his due proportion to the cost of construction and maintenance of our highways, then, and only then, can this Commission regard his use, under proper conditions and restrictions, of a great and tremendously expensive public facility as of equal dignity and equal benefit to the people with the moderate use thereof by the ordinary taxpayer."

#### STEVENS DURYEA RECEIVERSHIP

Springfield, Mass., May 13—Harry G. Fisk of this city and Frank H. Shaw of Chicago were appointed receivers for Stevens Duryea, Inc. of Chicopee, Mass., in Superior court here. This action was on petition of the Fisk Tire Co., Inc., by recommendation of the creditors' committee. The petition was uncontested.

President Ray S. Deering gave out a statement in which he said the company had relied on New York and Chicago banks for credit and the closing of one bank last January had cut off one of its principal avenues.

He added that the creditors had found the company to be solvent and that it is contemplated the receivership will be temporary. Sales have been increasing, he said, and orders are sufficient to keep the plant operating for two months.

## Willys-Overland Has Good Report for Owners

Toledo, May 13—Gratifying reports of the outlook for the Willys-Overland Co. were made to the stockholders at their annual meeting here this week by President John N. Willys. He said that delay in obtaining materials in sufficiently large quantities was all that prevented maximum production and that the company is over-sold on several thousand orders.

Dealers all over the country are clamoring for cars and the company is allotting them only portions of their orders, Willys said. The officers of the company believe that supplies of materials will be large enough to permit maximum production in July. April was one of the biggest months in the history of the company with sales and orders far in excess of the output. More Overland and Willys-Knight cars were sold at retail the first week in May than in any previous week with one exception, Willys declared.

Two new directors were elected, Frank G. Allen of Moline, Ill., will take the place of J. R. Harbeck of New York, and C. M. Keys was added to the board. Allen will represent the Moline Plow Co. on the board. Keys is at the head of the Curtiss Aeroplane & Motor Corp.

#### WHEEL MEN RESUME ACTIVITIES

Chicago, May 15—The Automotive Wood Wheel Manufacturers' Assn., reorganization of which was effected at Detroit recently, has resumed its activities at its old office at 105 West Monroe street, Chicago. The office is in charge of Hargrave A. Long, who was elected secretary and treasurer of the association. Thomas A. White, president of Crane & MacMahon, Inc., St. Mary, O., was elected president, and C. F. Field, general sales manager of the Hayes Wheel Co., Jackson, Mich., was elected vice-president. The following were elected trustees: C. C. Carlton, secretary of the Motor Wheel Corp., Jackson, Mich.; S. Vance Lovenstein, president of the Schwarz Wheel Co., Philadelphia, and C. F. Field. The association is organized as a corporation not for profit under the laws of Ohio.

#### I. H. C. AT 50 TRUCKS A DAY

Springfield, O., May 13—Although handicapped by lack of material the Springfield factory of the International Harvester Co. is keeping up with its schedule of 50 motor trucks a day, according to announcement made by Superintendent Charles H. Smart. This schedule will be maintained until July.

## Directors of N. A. C. C. See No Indication of Sales Slump

### Find Large Proportion of Retailing Is On Time Basis—Believe Prospects Good for Fall

NEW YORK, May 15—Directors of the National Automobile Chamber of Commerce, at their meeting in Detroit last week, were unable to detect any signs of a slowing up in the flood of orders for motor vehicles. Dealers in all sections of the country, except in a few agricultural districts, report that there were no indications of a falling off in sales. There has been a great improvement in the used car market and dealers now are trading cautiously, turning their stocks over quickly. The truck business is improving very rapidly. Sales of heavy duty vehicles are best in Chicago where a large number are being used in building operations.

One extraordinary feature of the present sales situation is that from 35 per cent to as high as 80 per cent of the retail business is on a time basis. This is construed to indicate that by no means all of the sales now being made are the result of increased purchasing power resulting from high security prices.

It was the opinion of many of the manufacturers that the utility top car, or low priced enclosed car, will have a very heavy sale after July 1 and that this will tend to keep the plants making models of this character running at capacity.

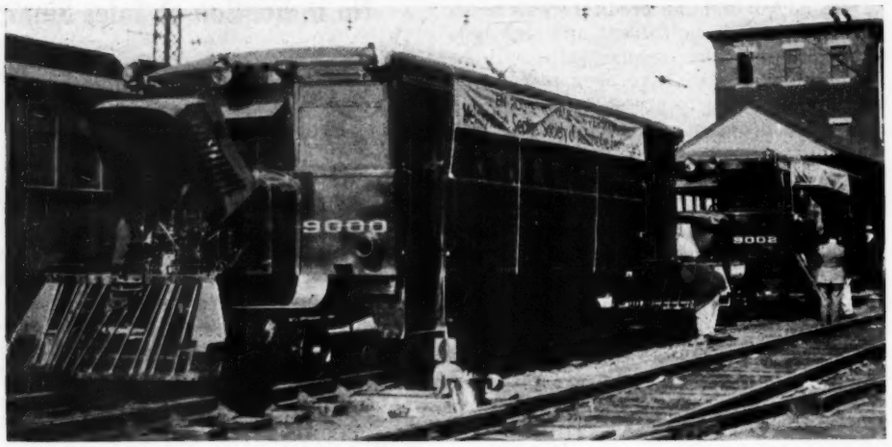
The directors decided to appoint a committee which will be headed by Roy D. Chapin to confer at Washington, May 24, with representatives of the Bureau of Roads and the National Association of State Highway Officials, in reference to a general road program. While the subjects to be considered have not been worked out in detail, one of those taken up will be the financing of highways. The decision of the automotive industry is that all property and all residents along improved roads benefit from them and for that reason motor vehicles should not be taxed for their construction. It is admitted, however, that inasmuch as motor vehicles are the chief users of the highways the taxes imposed upon them should pay the maintenance costs.

#### AUTO-LITE SALE MAY 29

Toledo, May 13—The court order signed last week by Judge John M. Killits in federal court here has set the sale of the Electric Auto-Lite division of the Willys Corp. for May 29, at 11 o'clock at the county court house in Toledo.

The upset price stipulated in the advertisement of sale is $4,700,000. It is understood here that C. O. Miniger, at the present time operating head of the Electric Auto-Lite and one of the receivers, will be probably the only bidder for the plant.

# Mack Gasoline Powered Rail Car



FOR railroad lines which cannot be economically served by steam or electric trains because of the lack of traffic volume, the Mack gasoline rail car has been developed. With these carriers frequent service can be provided at a profit to the railroad where in many cases even the minimum one-a-day franchise-holding steam train schedules would occasion a loss.

## No Let-Up in Chicago Sales; Tractors Selling

Chicago, Ill., May 12—Chicago retailers are feeling now a little relief from the rush of spring orders. Although there has been no let-up in sales, as a whole, the dealers report better facilities for handling customers.

Due to a lack of help in the body factories, many plants are held up on deliveries and as a result, many people are still waiting for cars bought some time ago.

James V. Bray of the Pomeroy-Bray Motor Sales Co., says that that firm has oversold its figures on Ford sedans and that phaetons are also approaching quota.

Another recently organized Ford agency reports that they have sold seven tractors within the last 10 days and that demonstrations for several more are going to be made soon. Two of these tractors were sold to farmers operating truck farms near the city while the others were sold to road construction companies.

### CREDITORS CONTINUE BUSINESS

Hartford, Conn., May 11—Robert C. Morris, of Morris, Plante & Saxe, New York lawyers representing the creditors' committee, today bought the property and business of the Hartford Automotive Parts Co. for $250,000 when it was offered at a receiver's sale. It is understood that the creditors will continue the business.

### VELIE SHIPMENT FIGURES

Moline, Ill., May 12—Velie Motors Corporation shipped 410 automobiles the first fortnight of the month. Some departments will go on overtime to maintain production schedules. About 75 per cent of the normal force is employed.

### CHEVROLET INCREASES FORCE

Oakland, Cal., May 6—The Chevrolet Motor Co.'s factory here is increasing its working force to reach a production of 1,000 cars a week, according to announcement by W. C. Williams, superintendent of the plant. Production for March was 2,800 cars, with 600 men employed. For April, it will run above 3,000 cars, and an effort is being made to pass the 4,000 mark in May. About 850 men will be required to meet this increase in production.

### DEMONSTRATION FOR SCHOOLS

Minneapolis, May 11—The Marmon engine Tear-Down Demonstration which has been on exhibition at many automobile shows will be taken before the technical schools in the near future. This demonstration has already been made before the Massachusetts Institute of Technology and Columbia University. Following these demonstrations other requests were received.

### MORELAND SALES INCREASE

San Francisco, Call., May 11—Increased sales of motor trucks by all dealers throughout the West are reported by the Moreland Motor Truck Co., which has increased the force of workmen at its factory at Burbank, Cal., to the maximum of 350. The largest demand is for the new, light and fast Moreland Road-Runner, of one and one-and-one-half ton models.

### MASON INCREASES

Akron, May 12—The Mason Tire & Rubber Co. this week has increased production from 2,500 to 3,000 tires a day and will make a further increase to 3,500 tires daily. By May 15 the company expects to complete its program of doubling its normal output of 2,500 tires daily.

## Durant Plans Production of 14,000 in Second Quarter

### In Addition, 1,000 New Stars Are to Be Made at Long Island and Lansing Plants

NEW YORK, May 15—Durant Motors, Inc. hopes to improve in the second quarter the remarkable showing it made in the first three months of the year when it ranked eighth among the automobile producers of the country, including Ford. With production being expanded as rapidly as possible, Durant hopes to pass one of its competitors by the close of the first half year.

Production of the Durant line for the second quarter is conservatively estimated at 14,000. The output at Long Island City will be at least 6,000, at Lansing 5,000, at Toronto 1,500 and at Muncie 1,500. This does not include 1,000 of the new Stars which will be turned out in June at Long Island City and Lansing. One hundred samples of the Star line will be made this month.

The sales policy for the Star has not been worked out in detail, but it is expected to include some rather unusual ideas when it is announced. It is understood to be the plan of the company to sell the cars to its distributors at cost and take a certain proportion of the profit.

### APPEAL TO CHAMBER OF COMMERCE

Washington, May 11—An appeal will be made by the National Automobile Chamber of Commerce for the support of the Chamber of Commerce of the United States in obtaining action on the so-called Graham bill and for relief from unjust excise taxes at the 10th National meeting of this body here May 16. The N. A. C. C. has prepared several resolutions on which action will be requested in order that all business organizations belonging to the United States Chamber of Commerce will support these measures. Support of plans for development of highways will also be asked of the convention.

### GENERAL MOTORS OFFICERS

New York, May 13—At its annual organization meeting, the board of directors of the General Motors Corp. re-elected all officers for the coming year. Membership on the finance committee was increased from 10 to 11 by the addition of Alfred P. Sloan, Jr., vice-president in charge of operation.

### KOKOMO PLANTS BUSY

Kokomo, Ind., May 15—The plant of the Haynes Automobile Company is said to be operating near to capacity, and working up to a schedule of 40 cars a day. The Apperson plant is also feeling the increased spur of the revival and is now said to be at about 75 per cent of capacity.

# Trade Associations Render Public Service, Says Reeves

## Manager of N. A. C. C. Tells Manufacturers of Benefits of Lawful Activities of Organizations

NEW YORK, May 13—Service which is of direct benefit to the public supplies the best proof of the increasing need for properly conducted trade associations, according to Alfred Reeves, president of the Trade Organization Executives of New York, who addressed the convention of the National Assn. of Manufacturers this week on "Relations of Trade Associations to the Public."

Reeves, who is also general manager of the National Automobile Chamber of Commerce, asked that so-called "open price bureaus" be not put in the class of trade associations, with their score of activities that have no relation to prices or production. Trade association activities of value to the public include research work which makes for more scientific use of products, activities relating to more prompt delivery of goods, better service, more uniform standards of design and material as a basis for comparison; protection against untrue or exaggerated forms of advertising; the elimination of unnecessary styles; the reformation of unfair trade practices that tend to deceive and, of course, the thing which is of very definite value to the consumer—lower prices for the things he buys.

Reeves declared trade associations do not want exemptions from the terms of the Sherman law, but want the fundamentals of that law maintained. He questioned the need for any more legislation, asking for a vigorous enforcement of present laws in the belief that present governmental departments had ample powers to investigate those trade association activities which Herbert Hoover says are in the "twilight zone."

"Some trade associations and open price bureaus which have to do with the so-called 'open price competition' are under fire," said Reeves, "but they are only a small percentage of the 500 or more trade associations that have become such an important factor in the upbuilding of American trade in this country and also to meet the competition in our struggle for the world's markets.

"Trade Associations are a natural result of the concentration of effort toward lower prices for better goods, to the ultimate broader purchasing power by the public.

"The trade association is a voluntary organization to which all of standing in the same line of business are admitted to membership. It is not autocratic. It undoubtedly supplies the greatest benefits to the small manufacturer or dealer. In a vast number of cases, it does not include some of the biggest manufacturers, which disposes of the suggestion that trade associations make for monopoly. Most of them aim to cut out duplication of work, to simplify manufacture and to make products better; and to reduce the required capital on the part of manufacturers and merchants.

"Price is something which most trade associations studiously avoid, but as associations in such activities are well known, an investigation by the proper governmental department should prove quickly whether or not they are operating in violation of law."

# Illinois Association to Have Speakers' Bureau

*Peoria, Ill., May 15—A speakers' bureau is being organized by the Illinois Automotive Trade Assn. Manager F. C. Zillman has written to each local association affiliated with the state association asking for the names of members capable of making interesting talks before gatherings of automobile dealers. He also requests the secretaries and managers of local associations to suggest new lines of work which the state association can take up.*

### WHITE 50 PER CENT INCREASE

Cleveland, May 13—Business of the White Motor Co., increased 50 per cent in April of this year over the corresponding month last year.

During last month the company received 987 orders, as compared to 640 in the same month of 1921. The announcement of the figures was made by Walter C. White, president, at the annual meeting of the corporation.

In April the company delivered 855 trucks, or 20 per cent more than were delivered in April, 1921. Factory production is increasing and since April, 750 additional men have been employed. This brings the number on the factory payroll up to more than 3,000.

### A. E. A. HANDBOOK, JUNE 19

Chicago, May 13—The standardization handbook of the Automotive Equipment Assn. will be ready for distribution at the Colorado Springs convention beginning June 19, according to Secretary Charles Hughes of the Standardization Committee. One section of the book will be devoted to a history and outline of the activities of the association, another section to the listing and description of practices recommended as standard in the manufacture and distribution of automotive equipment, and a third section to S. A. E. standards of interest to the automobile equipment industry.

### LAUSON TRACTORS REDUCED

New Holstein, Wis., May 13—The John W. Lauson Mfg. Co. announces the following reductions in price on three of its models:

| | Old Price | New Price |
|---|---|---|
| Lauson 15-25 | $1685 | $1495 |
| Lauson 15-30 | 1985 | 1875 |
| Lauson Rd., 15-30 | 2225 | 2100 |

# Demand Exceeds Output of Milwaukee Factories

## Makers of Cars and Parts Find It Difficult to Keep Up With Orders

MILWAUKEE, WIS., May 15 With all passenger car factories in this district shipping cars to distributors and dealers as fast as they come through the shops, and unfilled orders, especially for enclosed types, piling up at a rate that is reminiscent of 1919 conditions, the automotive industry at the middle of May stands in an especially gratifying position. The improvement noted in motor truck demand in the last 60 days is steadily being accentuated as the transportation problem of general business becomes more difficult with the increasing demand for commodities of all kinds. The tractor and power farm operating equipment industry is now experiencing a definite revival, although it still has far to go to get to a satisfactory basis.

In Milwaukee, one of the world's principal centers of automotive parts production, makers of engines, transmissions, universal joints, steering gears and similar units are unable to make deliveries in the volume demanded by shipping directions, which have advanced sharply in the last four to six weeks. Makers of car manufacturers' equipment, such as lamps, switches, coils, and grease cups, also have fallen behind on deliveries because production has not been able to keep pace with requirements, despite great effort.

Tire manufacturers are making further increases in working forces and enlargement of daily output. Concerns making automotive equipment for the wholesale and jobbing trade as distinguished from manufacturers' stock equipment, report a marked increase in sales, due to the improved condition of consumer demand. Producers of fenders or bumpers are especially busy, the demand at this time being of relatively enormous proportions. Discounts on collision insurance rates for bumper equipment have helped bring about this condition.

### TOLEDO FACTORIES GAIN

Toledo, May 13—Automotive plants made a large gain in employment during the month of April, according to statistics secured for the United States Department of Labor here. The Electric Auto-Lite Corp. put on 300 more employes, the Willys-Overland Co., added about 400, and the Toledo Chevrolet plant placed 100 more men at work.

### WALKER PLANS POSTPONED

Cleveland, May 13—The plan that had been worked out for the refinancing of the H. J. Walker Co., of this city, manufacturers of automobile motors, has been abandoned for the present, according to a statement made by one of the heads of the financing syndicate.

# CONCERNING MEN YOU KNOW

S. F. Bowser, president of the Bowser Co., Ft. Wayne, Ind., gas tank and pump manufacturers was interviewed recently by the American Magazine for the story of how he has built up his business.

W. A. Doody is now district sales supervisor of the Earl Motors, Inc., Rochester, N. Y.

Walter O. Singer has been appointed general salesmanager of the Advance Rubber Co., Brooklyn, N. Y.

Horace Hills, well known here for several years as a salesman of high-priced cars, has joined the staff of the Walter M. Murphy Co., Lincoln distributors for San Francisco.

C. F. Hewes has been made district representative for the Jordan and Marmon cars in Hartford county, Md.

William M. Reynolds, has joined the sales staff of the Burgess-Norton Mfg. Co., having given up his job as a manufacturers' representative, and will confine his efforts exclusively to traveling in the interests of the Burgess-Norton Mfg. Co.

Robert Griffith, Elgin, Ill., has closed his garage business and has purchased a half interest in the Ford agency at Kirkland, Ill., and which has been owned by Ralph Johnson. The firm will be known as Johnson & Griffith.

H. C. Hoch, Elgin, Ill., has disposed of his business, known as the Automotive Battery Co., to Walter Groth, who will hereafter be in charge.

W. M. Sheets, formerly of the Miami Cycle Works, has been made sales manager of the Lomar Mfg. Co., general offices and works, Middletown, O.

E. S. Partridge, one of New York's pioneer motor dealers has been appointed special representative of the Marmon Automobile Co., of New York, for the metropolitan district. He is specializing in sales analysis.

T. J. Biron, formerly with the Overland, has been appointed sales manager of Tennant Brothers, Chicago automobile bankers.

W. L. Stockinger, member of the engineering staff of the manufacturing department of the Studebaker Corp., is in San Francisco, assigned to the coast to make mechanical research investigations, and has established headquarters with the Chester N. Weaver Co., Studebaker distributors for this territory.

F. A. Bonham has resigned as manager of parts and service for the Chevrolet Motor Co., with headquarters at Detroit and has accepted a similar position with Durant Motors, Inc. His headquarters will be at the Long Island City Durant plant.

L. C. Wilkinson has been appointed successor to J. D. Isaacs as service manager of the Ford Motor Co., of Canada, Ltd.

J. C. Tegder has been appointed director of sales and advertising of Hanson Motor Co., Atlanta, Ga., manufacturers of the Hanson Six. He has been a motor car distributor for a number of years, and in 1910 was sales manager of the Staver factory, in Chicago.

T. L. Coleman has taken over the management of wholesale business of the New York Mitchell Motor Co. His association with this company comes after many years experience in the industry. Among other engagements, Coleman was general sales manager for the Chevrolet Co., of Canada, controlling the entire dominion, in charge of sales, service and manufacturing; general sales manager also for the Packard Motor Co., of Pittsburgh, and district manager for Hare's Motors, traveling through the east and south.

J. M. Richardson, Waverly, Ill., has sold the garage, he has operated for many years, to Luther Hunt, and the former removes to Los Angeles, Cal., to make his home.

T. V. Graves, Decatur, Ill., for several years manager of the Fisk tire and accessory store, has been transferred to the Peoria, Ill., branch of the same company and has been succeeded as manager at Decatur by J. F. Fox.

George S. Burch, vice president of the Comfort Windshield Co., Minneapolis, was accidentally killed at his home while cleaning an automatic pistol.

L. C. Hutz, for several years purchasing agent for the Pierce-Arrow Co., has become sales manager of the Canadian plant for the Fedders' Mfg. Co.

Howard J. Deitz, son of the late Robt. E. Deitz, manufacturer of the first automobile lamp, is dead at his home in New York.

R. A. Reynolds, president; C. H. Burt, secretary, are the officers elected in the Phelps (N. Y.), Automobile Club.

H. L. Heitzman, secretary of Fedders Mfg. Co., Buffalo, who has just completed a tour and survey of Canada, which has resulted in the locating of a branch factory at Bridgeport, Ont., for the production of Fedders radiators and parts.

W. A. Kelley, Ford dealer, died suddenly Thursday, at Tucson, Ariz. Kelley started in business at Springfield, O., 10 years ago.

President H. S. Berlin and General Salesmanager H. A. Grubb, of the Victor Rubber Co., Springfield, O., are visiting the company's distributing houses at Chicago, Kansas City and New York City. They are getting in touch with the situation and according to reports received at the plant there is an increasing demand for the Victor tires. H. H. Durr, treasurer of the company, said that business is steadily improving and that they are doing considerable shipping of cord and fabric tires. The company is turning out a large number of rubber mats for the Ford Motor Co.

W. E. Frankenfeld, Springfield, Ill., has opened the Centennial garage and will specialize in repair and storage. There are 9,000 square feet of floor space in the new plant and it ranks with one of the finest of the kind in that city. There will be day and night service.

Gilbert Woodill, factory representative of the Kissel Motor Car Co., San Francisco, Hartford, Wis., has taken over the distribution of Kissel Cars in this section of California.

Ray Wise has been appointed sales manager for the Lou H. Rose Co., Chalmers and Maxwell distributors for northern California. The appointment was made by Rose following the resignation of J. L. Brambila. Wise has been factory representative for eastern automotive and other lines here for some years.

R. L. Barrett has been named service manager for the H. O. Harrison Co., Hudson and Essex distributors for northern California. Barrett has been for three years field service manager for the Hudson Motor Car Co., and for more than a year was Pacific coast representative for the Hudson factory.

Vigge V. Torbensen, Cleveland, has formed the Vig Tor Axle Co.

M. J. O'Connell, Freeport, Ill., has opened a factory for the manufacture of automobile tops. Automobile upholstery and other adjuncts to the motor car will be produced. The same plant will manufacture tool kits for motor car owners, one order for 500 outfits being received this month from a Chicago accessory distributor.

Louis E. Strothman, vice president and general manager of the Richardson-Phoenix Co., Milwaukee, now a division of the S. F. Bowser Co., Ft. Wayne, Ind., died May 8, after an illness of six months, at the age of 43 years. He was internationally known as an engineer, and before joining the Richardson-Phoenix Co. in 1919, was chief engineer and general manager of the steam turbine and pumping engine department of the Allis-Chalmers Mfg. Co., Milwaukee.

George L. Lorch, superintendent of the Eagle Mfg. Co., Appleton, Wis., manufacturing Eagle tractors and power farm tools, has resigned to accept a similar position with the U. S. Tractor & Machinery Co., Menasha, Wis., manufacturing Uncle Sam tractors and now engaging also in the production of tractor implements and power farm machinery.

Henry S. Lord, vice president and treasurer of the Moline Plow Co., Moline, Ill., has resigned. He has been associated with the Moline Plow Co. 10 years.

L. E. Latta, secretary of Earl Motors, Inc., and a member of the Earl board of directors, has resigned to take charge of the legal department of a large financial corporation. Latta has been connected with the automobile indusrty since 1906.

Ralph D. Mock, until recently an executive officer of the Hydraulic Steel Co., of Cleveland, has become president of the Colonial Body Co., Boston, Mass. He was one of the organizers and is president of the Cleveland Finance Co., as well as the Metropolitan Securities Co., with which the former is now affiliated.

## REORGANIZE CROW-ELKART

Elkart, Ind., May 11—Efforts are being made to reorganize the Crow-Elkhart Motor Corp. which was thrown into receivership several weeks ago. It is proposed to have the assets taken over by a new corporation which would be known as the Century Motors Co.

# Hastings Dealers 'Feeling Good' After Biggest Month in Years

### One Dealer Has Sold As Many Cars As His Entire Output of 1921; All Optimistic

OMAHA, Neb., May 13—Automobile dealers in Hastings, Neb., are wearing smiles this week. They have just passed through the best month of automobile business in almost two years.

"We have already sold as many cars this year as we put out in the entire 12 months of 1921," one of the dealers said. "Our cash sales now fall but little short of the entire year's business for 1921."

One dealer said that though there had been no decided boom in the business, a gradual increase last month showed larger cash dividends than at any time during the past 15 months.

**Selling High Priced Cars**

Another Hastings dealer said that his business was at least 100 per cent better than it was 18 months ago and June 1 will show as great cash sales for the first five months of this year as the total for 1921.

The last 15 days have seen the sale of a number of the higher priced cars by Hastings dealers. Moderate priced cars are having a very satisfactory sale, and the lower priced cars are always in demand.

## USED CAR SALES EXCEED NEW

Detroit, May 11—Business in used cars in the Detroit district continues to exceed business in new cars, according to reports received by the Detroit Automobile Dealers' Assn., from members. In March dealers sold 50 per cent more used cars than were on hand April 1, leaving about a two-thirds supply for April with sales maintaining the same rate.

A tabulation by Manager H. H. Shuart of the association gives the percentage of clean sales and sales involving trade-ins as 26 and 74. With Detroit representing the most intensively sold automobile district in the country this is taken to indicate that many buyers are junking their former cars or are keeping them for continued use.

## LARGEST ACCESSORY MONTH

New York, May 11—Sales by members of the Motor and Accessory Manufacturers Association in March were larger than for any month since the collection of statistics began at the close of 1920, reaching a total of $28,670,000. Every month this year has shown a material gain in business. Even more striking than the increase in sales for March was the decrease in the total of past due accounts, which was nearly 29 per cent, and in the total of notes outstanding which was approximately 24 per cent.

# IN THE RETAIL FIELD

**Rockford Motor Co.**, Chicago, has been appointed distributor in Chicago territory for the Mitchell automobile. The arrangement with the Rockford company includes the establishment of community sales and maintenance stations in all parts of Chicago.

**Maryland Motors, Inc.**, will start at once on the construction of large new showrooms and maintenance station at Baltimore. The firm handles the Durant car and will add the Star. Plans have been made to make the showrooms and maintenance station one of the largest and best in the state.

**Nash Motor Sales Co.**, Minneapolis, has begun operation under the new system by which the district is free from supervision by the Chicago office. This succeeds the Nash Sales Co. formed five years ago by J. H. Ramsden and controls Minnesota, the Dakotas, Montana and northern Wyoming. C. D. Voorhis is vice president and director of sales. S. G. Dunderson has been advanced from assistant manager to secretary-treasurer.

**Tuna Motors, Inc.**, St. Paul, has been appointed distributor for the Earl car. This is the entry of this car into the market.

**F. J. Kelley**, New Orleans, Louisiana, has taken the Louisiana distributorship for the Hudson Six, and **Law Motor Co.**, Biloxi, Mississippi, the southern Mississippi territory.

**J. N. Ward** and **W. W. Brink** have organized the Moon Motor Sales Co., New Orleans, and opened display rooms and a repair shop.

**Jamaica Motor Service Corp.**, Jamaica, Long Island, N. Y., has taken on the distribution of the Peerless eight cylinder car, for Jamaica and surrounding territory.

**R. G. McFann** and **T. W. Coble** have taken over the Twenty-first Street Garage, Toledo, and will operate it as a maintenance station for electric cars. They have been appointed dealers for the Detroit electric. McFann will have charge of new cars and Coble will supervise service.

**Block & Schappy Tire and Vulcanizing Co.** has opened offices at Davenport, Ia. John J. Block was in the tire business here prior to the war and in service worked in the automobile repair branch. **Joseph T. Schappy** has been in the tire business in the tri-cities seven years.

**R. H. Collins**, president and general manager of the Peerless Motor Car Co., of Cleveland, announces the appointment of the Park Automobile Co., as Peerless distributors in the St. Louis, Mo., territory.

**Hayward-Peterson, Inc.**, Omaha, Neb., announce that though they will no longer sell Nash cars but they will still maintain a Nash maintenance department in their garage.

**Nash Vriesema Auto Co.**, headed by Dan T. Vriesema, one of the best known automobile merchandisers in the country, has been organized to take over the distribution of the Nash passenger cars in Nebraska, Iowa, except the eastern one-third, and the southeastern part of South Dakota.

**Sprague Tire and Rubber Co.**, of Omaha, has opened a service station in Council Bluffs, Ia., with M. A. Copely in charge and J. F. Pieper as an assistant.

**Sulzer Battery & Equipment Co.**, Columbus, O., is the name of a new concern which has opened in temporary quarters to handle Presto-Lite batteries and gas tanks in Columbus and central Ohio. L. E. Sulzer, formerly with the Automotive Equipment Co., is secretary and general manager. A new building will be erected to house the company.

## Corrects Durant-Milton Racing Advertisements

Chicago, May 13—An advertisement published here by the Durant distributor, throws light upon the recent action of officials of the A. A. A. in barring Tommy Milton's Durant special from racing on the Pacific coast. Following one of the early spring races in which Milton was winner, the Chicago distributor placed an advertisement in the newspapers saying that Milton had broken two world's records in a six-cylinder Durant. The distributor is now advertising that this was an error and the car driven by Milton was constructed outside the Durant factories and was powered with an eight-cylinder racing engine.

R. C. Durant also issued a statement at San Francisco declaring that Milton never misrepresented the car he was driving and the only misrepresentation was that mistakingly made by the Chicago distributor without the knowledge of either Durant or Milton.

### TWO COLUMBUS ASSOCIATIONS

Columbus, May 12—A split in the Columbus Automobile Trade Assn., has occurred and in its place have developed two organizations. One, styled the Columbus Automobile Dealers Co., comprises practically all of the dealers and excludes garagemen, tire and accessory dealers and other branches of the industry. This association is without a president, since the death of Harry J. Schwartz recently. R. H. Mitchell is secretary and A. B. Coates is treasurer and manager. A meeting will be called soon to elect a president.

The other end of the organization, has retained the former corps of officers. H. M. McCord is president, A. J. Fishbach, vice-president and E. C. Brisley, secretary. Steps will be taken to reorganize this section which is named the Columbus Automotive Trade Association and which includes in its membership tire and accessory dealers, repair men, garagemen and top repair men.

### "QUALITY AND NOT QUANTITY"

San Antonio, Tex., May 13—"Quality and not quantity" probably will become the ideal behind a new membership plan that will be instituted by the Texas Automotive Trade Assn. in the next few weeks. W. A. Williamson, secretary and manager, at his office here has verified that the new plan will be complete and ready for announcement soon, but withholds details.

### TIRE LAW TO BE TESTED

Dallas Tex., May 11—Constitutionality of the Texas statute which limits the legal thickness of commercial vehicle tires is to be tested in an appeal filed in Austin, in which a truck owner asks for reversal of a decision against him in a local court. He was charged with a violation of the statute, on accusation of operating a truck with solid tires of less than one inch thickness.

### NASH SHIPMENTS UP

Kenosha, Wis., May 12—The Nash Motors Co. announces that it shipped 18 per cent more cars last month than in April, 1921. The sales for the first quarter of 1922 showed an increase of nearly 52 per cent over the corresponding period last year.

## General Motors Says Third Quarter Will Excel Second

### Careful Investigations and Analysis On Part of Executives Makes Them Hopeful

NEW YORK, May 13—The General Motors Corp. which is now doing an exceedingly gratifying business in all its passenger car lines expects sales for the third quarter of 1922 will exceed those of the second quarter. This belief is based on careful investigations and analyses which have been made. These reports point to a very large demand during the mid-summer months for Cadillacs, Buicks and Chevrolets, the three leading passenger car lines.

Not only is the domestic business of General Motors Corp. running at a higher level but there has been a very gratifying increase in export demand. The schedules of the London branch have been materially increased in the past week.

### New Air Cooled Design

The new air cooled car which has been developed by C. F. Kettering in the research laboratories at Dayton and which has been subjected to a long series of the most severe tests, will be turned over in a short time to the Chevrolet Motor Co. for practical experiments along manufacturing lines. Manufacture of experimental models will be under the direction of W. S. Knudson and such practical modifications as are necessary will be made.

Thorough tests will be made of the models turned out by the Chevrolet company and it is expected that manufacture of the new line in small quantities will begin early in September. At the beginning only 15 or 20 a day of the air cooled line will be turned out. It is expected that the new line will sell for about $150 more than the Chevrolet 490.

It can be stated positively that the new air cooled line, which is purely experimental up to this time, will have no effect whatever on the "490" line which will be continued as heretofore.

### ROLLS-ROYCE INCREASING FORCE

Springfield, Mass., May 11—Orders are being received at such a gratifying rate at the Rolls-Royce works that it is planned to make another addition of 200 men to the plant force May 15, bringing the factory to practically normal production. The feature of the selling situation is the continued large demand for enclosed cars.

### TIRE COMPANY IN COURT

Akron, O., May 12—The referee in bankruptcy here has recommended to the United States district court at Cleveland, that the Avalon Rubber Co. be adjudicated in bankruptcy and that trustees be appointed. Since last November the company has been in the hands of a receiver.

# BUSINESS NOTES

**Amco Co.**, Indianapolis, has been incorporated to succeed the American Metals Co.

**Durant Motor Corp.** has been granted a permit to erect an office building in Oakland, Cal.

**Fisher Auto Supply Co.**, Peoria, Ill., has opened a branch at Canton, Ill., and will carry a complete line of motor vehicle accessories.

**Superior Tire & Rubber Co.**, Chicago, has been incorporated for $5,000 to deal in automobile tires and accessories.

**Acme Body Top Co.**, Aurora, has been organized to build and deal in tops, bodies and accessories for automobiles.

**Edgewater Motor Sales Co.**, Chicago, $50,000 capital, has been incorporated to deal in automobiles and accessories.

**Columbus Ignition Co.**, Columbus, O., has been chartered with an authorized capital of $50,000 to take over the Columbus branch of the Bissinger Magnetic Co. The company deals and gives service on several lines of ignitions. R. B. Gargett is manager of the company.

**Electric Machine Corp.**, Indianapolis, has moved into larger quarters, increasing its floor space and manufacturing facilities four times, and is expanding both its output of electric testing machines and of wireless apparatus and equipment.

**Simming & Sloan**, Minneapolis, deal in quality used trucks, but their stock in trade is only a desk and a typewriter and two chairs. Yet they do a big business, based on their high standing in the community. They sell trucks on consignment and buy trucks to order, and often are paid for them before they are delivered.

**Postal Tire Syndicate, Inc.**, Chicago, will deal in tires by mail to the consumer. Capital, $25,000.

**National Association of Taxicab Owners**, secretary's office, has been moved to Chicago from Washington, D. C., and the association has started publication of the Cab News, a monthly paper devoted to the taxicab industry. J. G. Williams is secretary of the association.

**Howard Mfg. Co.**, of St. Louis, Mo., has opened offices in Macon, Ga., at the Lanier hotel building, with E. H. Eckels in charge. The company manufactures the High Power One Piece Piston and Oil Scraper Rings.

**Tidewater Oil Sales Corp.**, San Francisco, Cal., sales division of the Tidewater Oil Co., manufacturers of Veedol oils, has increased its Pacific coast organization to 25 salesmen, covering Washington, Oregon and California, with headquarters in San Francisco, and F. M. Rowles in charge as western department manager. Three additional warehouses have been obtained in the wholesale section of San Francisco.

**Standard Motor Products Co.**, Chicago, will deal in and manufacture automobile accessories and supplies.

**Shuler Axle Co., Inc.**, Louisville, Ky., has started production on a line of front axles intended exclusively for motor busses. The company has for several years been making axles for trucks, tractors and trailers and these will be continued.

**Hartford Automobile Club Garage Co.** at a meeting held this week voted to sell its assets on such terms as the directors may find expedient and to grant options to purchase to certain parties who are ready to look over the property with the idea of purchase. These parties are to assume the liabilities and build a large garage on the site where the club has planned to erect a building. The garage company owns the lot for which it paid $212,000 with the buildings thereon which have been demolished. The value of the lot is estimated at $120,000 at the very most. About $60,000 was used for organization expenses.

**Indiana Section of the Society of Automotive Engineers** has elected the following officers: Chairman, O. C. Berry, engineer of the Wheeler-Schebler Co.; vice chairman, Lon R. Smith, vice president of the Mid-West Engine Co.; secretary, B. F. Kelly, Weidley Motors; treasurer, Mark A. Smith, Mid-West Engine Co.

**Illinois Valley Motor Co.**, has been organized at Peoria, Ill., and will handle motor vehicles and accessories. Capital stock has been fixed at $50,000. The promoters are William F. Shanemeyer, Ray C. Becker, N. A. Bolle, H. W. Fisher, H. W. Biehl, Russell Wehner, and G. B. O'Dell.

**Hunt-Graham Tire & Accessory Co.**, Aurora, Ill., has been organized with capital stock of $20,000, and articles of incorporation have been issued. The promoters include R. C. Putnam, G. T. Johnson and Charles Dickerson.

**Liberty Motor Co.**, Liberty, Ill., has been incorporated for $15,000 to deal in cars and trucks.

**Apperson Motor Co.**, Springfield, Ill., has been reorganized with Carl G. Wiesenmeyer as president and general manager. The company will distribute both the Apperson and Columbia cars. Wiesenmeyer will retain his tire business which he has been conducting for many years, while Ward will be in charge of the car distribution.

**National Auto Supply Co.** has opened an accessory store in Decatur, Ill., W. O. Argraves of Rockford, Ill., will be manager. The same company has branches in Chicago, Rockford and Peoria, and plans to open others at various points in Illinois.

**Hilmer Motor Sales Co.**, Springfield, Ill., has been reorganized by the entrance of J. C. Anderson into the company as salesmanager. For seven years, he filled the same position with the Briscoe Motor Sales Co., of St. Louis, and previously with the Earl factory.

**Frank J. Edwards**, president of the Edwards Motor Car Co., Milwaukee, distributor of the Dodge, was elected president of the Milwaukee Automotive Dealers' Assn. at the annual meeting. **M. E. Newald**, Stewart truck dealer, vice president; **R. W. Leach**, manager of the Curtis Auto Co., Reo, secretary, and **Jesse A. Smith**, Hudson and Essex, treasurer. **Bart J. Ruddle** continues as executive director and manager.

**James Gibbons**, Production Tools, Milwaukee, have moved to new and larger quarters. The concern is exclusive representative in Wisconsin, Minnesota and upper Michigan for these manufacturers: Hanniin Mfg. Co., Chicago, boring and reaming tools, air chucks, air arbor presses; Nelson-Blanck Mfg. Co., Detroit, multiple drilling heads; Chapin-Skelton Tool Corp., Syracuse, tapered reaming tools and counterbores; Van Dorn Electric Tool Co., Cleveland, portable electric drills, reamers and grinders.

**Geo. L. Wastjen & Co.**, Milwaukee, manufacturers and wholesalers of plywood and veneers, have taken occupancy of a new three-story fireproof factory, warehouse and office building, affording about 200 per cent more room than the quarters occupied for many years. The concern is well known in the automotive industries, especially for large plywood panels for closed body tops, body panels and similar materials.

**Bullard Mfg. Co.**, Madison, Wis., organized a year ago to manufacture piston rings and other gas engine specialties, has moved its plant and offices.

**Stowell Co.**, South Milwaukee, Wis., a large producer of malleable castings and now also conducting an electric steel and an open hearth steel foundry in Milwaukee, has increased its capitalization from $200,000 to $300,000 to accomodate the enlargement of its operations.

**Automotive Battery Co.**, Indianapolis, Westinghouse battery distributor for Kentucky and Indiana; the Kokomo Tire and Rubber Co., of Kokomo and the Gulf Refining Co., announce that they will open May 13 in Louisville one of the largest battery, tire, fuel and oil stations in the south. This office will serve as the Kentucky headquarters of the local Automotive Battery Co. and as the headquarters of the southern division of the Kokomo Tire and Rubber Co.

**Opitz Mfg. Co.**, of Milwaukee, is the name of a new corporation organized under the laws of Wisconsin with $150,000 capital stock to engage in the radiator business.

**Columbus Auto Brass Co.**, Columbus, O., will soon complete the new building adjoining its plant which will be used as a repair department. The structure is 40 by 60 feet and is of brick construction. The repair department has been maintained a half mile away which has been very inconvenient. New machinery will be installed.

**Ohio Motor Bus Co.**, Columbus, O., with its affiliated companies, the Columbus Terminal and Motor Bus Co., the Motor Vehicle Transportation Service Co., and the John R. Stewart Co., has taken a five-year lease on large office space. Vincent Keenan, formerly traffic manager of the Fifth Avenue Coach Co., of New York, has taken charge of the operation of busses. Steps are being taken to open a number of bus lines to nearby cities and towns.

**Hurst Co.** to handle Cleveland and Chandler automobiles in Berks county, Pa., with headquarters at Reading, has been formed by John B. Hurst, who was for 12 years connected with Herbert Bros., Philadelphia distributors for Cleveland and Chandler, for the last five years as retail salesmanager.

## Attack on Used Car Methods Causes Bureau to Disband

### Wisconsin Organization Dissolves When Attorney General Holds Activities Illegal

MILWAUKEE, WIS., May 15—The Wisconsin Automotive Statistical Bureau, incorporated a short time ago as a non-stock corporation by a number of Milwaukee distributors and dealers, has been voluntarily dissolved, notice of dissolution being filed May 9 at the Secretary of State's office in Madison.

This action followed a movement recently instituted by the Attorney-General of Wisconsin, charging that nine combinations of dealers existed in various sections of the state for the purpose of fixing allowance and resale prices on used automobiles.

The action of the Attorney General was part of a series of so-called "trust-busting" suits which his department has instituted in the past six months against manufacturers, jobbers and dealers in at least a score of principal merchandise commodities. The suits were brought under a Wisconsin statute known as the "anti-trust" law, modeled after the Sherman Federal statute.

### ILLINOIS EXECUTIVE COMMITTEE

Peoria, Ill., May 6—President B. B. Burns of the Illinois Automotive Trade Assn., has appointed an executive committee composed of the following: H. B. Pinkerton, Peoria; Paul J. Killeen, Galesburg; H. E. Halbert, Chicago; H. R. Horstman, Alton, and W. H. Williamson, Rockford. Members of the legislative committee are J. L. Murray, Bloomington, chairman; R. C. Schnell, Beardstown, and R. C. Cook, Chicago.

Secretary F. C. Zillman has been authorized by the Board of Directors to conduct a membership campaign throughout the State.

### HOURLY REDUCTION MOVES CARS

Hartford, Conn., May 6—A large stock of used cars was moved quickly here by Russell P. Taber, Inc., by means of a widely advertised sale in which prices were reduced $10 each hour from opening time in the morning to closing time at night. Sixteen cars were sold and most of them were moved fairly early in the day, the buyer fearing that if they waited too long some one else would get the bargain.

### TORONTO SALES REPORTS

Toronto, Ont., May 13—Automotive sales are reported "excellent" by some of the trade, "good" by many, "record-breaking" by a few and "slow" by one or two members of the local trade. With but few exceptions business is better in the larger centers than in the smaller ones throughout the country. Most of the larger Canadian automotive plants are at or near peak production.

# The Readers' Clearing House

## Questions & Answers on Dealers' Problems

### Mechanic's Lien Law in Kentucky

Advise if there has been a law passed in Kentucky to enable us to get a mechanic's lien over a valid prior mortgage duly recorded?—Parks Motor Co., Murray, Ky.

In 1918 the Kentucky Legislature enacted a law giving a lien to individuals or corporations who conduct the business of selling, repairing, furnishing accessories or supplies for motor vehicles on such motor vehicle for the reasonable or agreed charges, for repairs, work done, accessories or supplies furnished therefor, and for storing or keeping such machines.

Possession of the car may be retained as at common law, or if delivered back to the owner or his agent, the garagekeeper may retain his lien by filing a claim of lien with the county clerk within six months.

Any car remaining in possession of the garageman on which he holds a lien may be sold by him after 30 days, by first advertising said car for sale six days before in some paper of general circulation in the town or county where the work, materials, etc. were furnished.

These are the main features of the Kentucky law. It does not purport to give precedence to the lien over the lien of a valid prior mortgage duly recorded. The Supreme Court of Illinois held the Illinois statute giving such a priority to the garageman, invalid as being contrary to the constitution, and we are of the opinion that such a law in Kentucky would readily be so held.

### Arranging Path of Customers to Avoid Confusion

#### PLAN NO. 398

Q—We are enclosing a drawing of our salesroom and its arrangements. Would be pleased to have you give us any information you think would be of interest to us. We want same arranged as best we can and know that you are in a position to give us some very good ideas. —Davenport Tire & Rubber Co., Inc., Davenport, Ia.

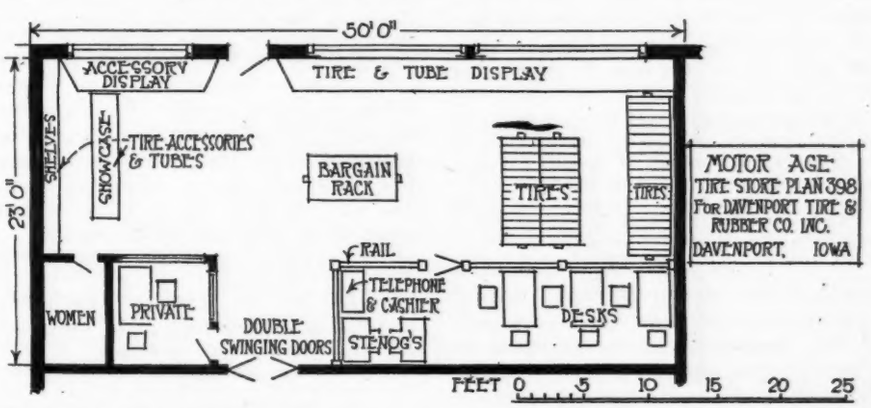
We have not materially changed your layout but believe the changes we have made will lessen the confusion and tend toward the easier handling of customers.

First, the route through the store to the maintenance division should be as short and direct as possible, so that customers seeking maintenance do not interfere in any way with sales or customers waiting to buy. One of your routes leads through the office which is undesirable and the other leads diagonally across the sales floor, making confusion almost inevitable if there are any customers in the store.

We would think it advisable to reserve the large side of the store for the tire racks with plenty of room for customers to get in and see the goods. A man likes to get his hands on a tire and feel of it, not that he generally knows anything about rubber, but he has his likes and dislikes and is better satisfied if he sees and approves of what he is getting.

The small side should be equipped with shelving for tubes and tire accessories with a well-kept showcase for showy things that find ready sale.

If more tire storage space is needed, a stockrack suspended from the ceiling may extend across the entire back of the room. The bottom of this rack should be 7 ft. from the floor so that there would be no interference with headroom.




### Architectural Service

IN giving architectural advice, MOTOR AGE aims to assist its readers in their problems of planning, building and equipping, maintenance stations, garages, dealers' establishments, shops, filling stations, and in fact, any building necessary to automotive activity.

When making request for assistance, please see that we have all the data necessary to an intelligent handling of the job. Among other things, we need such information as follows:

Rough pencil sketch showing size and shape of plot and its relation to streets and alleys.

What departments are to be operated and how large it is expected they will be.

Number of cars on the sales floor.

Number of cars it is expected to garage.

Number of men employed in repair shop.

And how much of an accessory department is anticipated.

### CHANGING GEAR RATIO TO ACCOMMODATE SMALLER WHEELS

Q—We have a 1913 Buick model 40 that has 36x4 tires and we wish to cut down the wheel size so as to take 33x4½ tires. This car has a 12 tooth driving pinion and a 49 tooth bevel ring but the differential gear is made so as to take 12, 13 or 14 tooth driving pinion. Which one of these pinions would be correct with the 33 in. tire to give the same road speed at a certain engine speed that we now get with the 36 tire and 12 tooth pinion?

1—The 13 tooth pinion with the 33 in. wheel will give the same ratio of engine speed to car miles per hour that you are now getting with the 12 tooth pinion and 36 in. wheel.

2—Would 33x4½ or 34x4½ be better size for this car, which weighs over 3,000 pounds?

2—The carrying ability of the tire is determined by the width so there will be no difference in this respect. As the 33 in. wheel will put the car closer to the ground we would recommend this size.

3—Supply names and addresses of firms that can cut the wheels down.—O. C. Malmidal, Bisbee, N. D.

3—This information will be given by letter.

### The Readers' Clearing House

*THIS department is conducted to assist dealers and maintenance station executives in the solution of their problems.*

*In addressing this department, readers are requested to give the firm name and address. Also state whether a permanent file of MOTOR AGE is kept, for many times inquiries of an identical nature have been made and these are answered by reference to previous issues.*

*Inquiries not of general interest will be answered by personal letter only. Emergency questions will be replied to by letter or telegram.*

*Addresses of business firms will not be published in this department but will be supplied by letter.*

*Technical questions answered by B. M. Ikert and P. L. Dumas; Legal, by Wellington Gustin; Paint, by G. King Franklin; Architectural, by Tom Wilder; Tires, by a Practical Tire Man; General Business questions, by MOTOR AGE organization in conference.*

## Current Consumption of Ford Ignition Coil

Q—What is the correct current to allow to flow through a Ford ignition coil when the vibrator points are closed so as to use it on some other ignition system? We have been inserting a resistance so that the coil draws three amperes and it has good results.

1—Five amperes is usually considered permissible on a 6-volt ignition system designed for four or six cylinders. If three amperes gives a strong enough spark however, would suggest that you continue to use this current, as the more current is taken from the battery the more rapidly the interrupter points will burn away. If you find the spark is too weak, however, you can use current up to 5 amperes and for 8 cylinder engines up to 6 or 7 amperes.

2—What is the greatest speed at which a Ford ignition coil gives good secondary spark? At what high speed does the secondary spark become weak on Delco, Connecticut, Remy battery ignition coils and on Bosch high tension magnetos.

2—The action of the regulation Ford vibrating coil depends so much on the condition of the timer and magneto that it is impossible to give definite information as to the greatest speed at which satisfactory ignition will be obtained. In general, however, variation in vibrator settings on different coils will cause variation in timing in the different cylinders which is not experienced with the other type of battery ignition which uses an interrupter and distributer. In regard to the greatest speed at which various ignition systems give a good secondary spark would say that this is confidential information but all of the ignition systems on the market were designed to give good secondary spark up to and beyond the speed at which the car can run, so that while the question may be of theoretical interest, it is of no particular interest from a practical standpoint.

3—When using a Ford ignition coil on some other system where does the other end of the secondary get its ground connection and how does the secondary current which jumps across the spark plugs return to the other end of the secondary?

3—When installing a Ford vibrating coil as a replacement coil on some other car by turning down the adjustment till the vibrator is held closed, the secondary current will return through the battery and the primary rather than through the interrupter points which are opened at the time the secondary spark occurs.

4—Is the Lambert friction drive car still being built?

4—The Lambert friction drive cars are not being built at present.

5—What is it that makes a piece of iron become hot when placed over a strong growler?—West Oregon Garage, Inc., Portland, Ore.

5—When a piece of solid iron is held over a growler the alternating current through the growler winding produces an alternating magnetic field and the change of magnetism in a solid piece of iron generates eddy currents which flow around in the iron and produce the heating that you observed as flow of electrical current through a material always produces heat. There is also some heat produced by the reversing of the magnetism, this being technically known as Hysteresis loss.

## Theoretical Speed to be Derived from Certain Gear Ratios

Q—What is the bore and stroke of the Duesenberg engine as used in the 1921 Roamer?

1—4¼ by 6.

2—Can you give me power curve of this engine, also its highest speed in r. p. m.?

2—This power curve is not available, but this engine delivers its maximum power at 2500 r.p.m.

3—At what speed will this engine carry a 3500 lb. car with a 53-12 rear in direct drive in fourth speed? Would you advise a different ratio than the 53-12 for this weight car? I want very good acceleration and am satisfied to sacrifice speed to get it.

3—You do not state the gear ratio in fourth. If you refer to the fourth as used in Roamer car this would be an overgear of 1¼. Assuming an engine speed of 2800 r. p. m. using a 34 in. wheel in third speed with a final reduction of 53-12 the car should show between 50 and 55 m. p. h. In a fourth speed geared 1¼ to 1 with the same final reduction the speed would be between 68 and 74 m. p. h. All of these figures are based on an engine speed of 2800 and it may be possible to raise this considerably higher than a maximum of 2800. By using the 4.42 or 53-12 ratio the third speed direct should give you an excellent getaway.

4—What is the rear end ratio on the 1921 Roamer (Duesenberg), what is the weight of this car? What is its approximate speed in 3rd gear, in fourth?

4—3.77 to 1 is the rear axle ratio on a 1921 Roamer Duesenberg. The weight of the car is 3450 pounds. We have been informed by the local Roamer distributor that the average factory run of Roamer cars equipped with the Duesenberg engine will show 67 m. p. h. in second speed, 75 in third, and 90 in fourth.

5—What type Duesenberg engine is used in the Meteor, its bore and stroke?

5—The Meteor uses the Rochester Duesenberg engine model G-1. The bore and stroke is 4¼ by 6 inches.

6—What type Duesenberg engine in the 1921 Roamer?

6—The 1921 Roamer uses the same style Duesenberg engine.

7—What type Duesenberg engine is used in the 1922 Revere, its bore and stroke?

7—The model G-1 Duesenberg is also used in the 1922 Revere. It has the same bore and stroke as the models used in the Roamer.

8—Is the Roamer using the same type Duesenberg in its latest car as it used in 1921?

8—Yes.

9—I am considering installing a Duesenberg power plant in a Chandler. I realize that it requires lots of work and am satisfied of that. Will you suggest a way of doing this job so as to have a good rugged layout?—Thomas Hofmeister, Overlea, Md.

9—One of the chief things to bear in mind in installing the Duesenberg engine in the Chandler chassis is if possible the same amount of weight should be on each of the four wheels in order to secure the best balance for high speed performance, and to prevent any ill effects in case of a tire blowing out. No doubt the installation of this engine will also require the addition of more cross-members to the frame structure. Particular attention should be given to the torque member of the rear axle to see that it is in very best shape. The installation of this engine also will require additional radiator capacity as you will no doubt find that the Chandler radiator is not adequate to efficiently cool this engine. The largest size tires that can be fitted to your present wheel should be installed and to secure good tire life the tire should not be less than 5 inches in diameter.

### STARTER ON 1917 MAXWELL OUT OF ORDER

Q—We have a 1917 Maxwell in our garage and as the starting motor is out of commission the owner wishes to have the wiring changed from a 12-volt to 6-volt system, installing a 6-volt battery. He figures on cranking the car by hand but wishes to have the battery for the lights and wishes to have the generator charge the battery. How can this be arranged? —O. E. Besch, Milwaukee, Wis,

1—You do not state exactly what is wrong with the starter. If it is merely the mechanical drive to the flywheel it will have no effect on the generator but any electrical trouble in the starter such as grounds or shorts in the field coil or similar trouble in the armature will prevent the machine operating as a generator.

However, if the starter is all right it will be possible to eliminate the present starting switch and all of the heavy cables, the small wire which goes from the instrument board to the old starter switch and now being connected to the live terminal of the battery, the other terminal being grounded. If the generator or part of the motor generator is all right it will operate satisfactorily when the engine is started by hand.

### VALVE SPECIFICATIONS 1920 CLEVELAND SIX

Q—What is the diameter and degree of the valve used on the 1920 model 40 Cleveland Six? What is the length and size of valve stem?—Perry Kolp, Manlius, Ill.

The head diameter of the valve in the 1920 Cleveland engine is 1 5/16 in., the angle of the seat is 45 degs. The diameter of valve stem is .309. The length from top of seat to bottom of valve stem is 5 13/32 in.

# Some Present Day Theories Covering Fuel and Compression Knocks

Q—What causes a spark knock in an automobile engine when what is called low grade fuel is used in the car? Would a spark knock occur with high test gasoline?

Provided the engine is clean of carbon, what method would you suggest for eliminating spark knocks? C. H. Armstrong, Birmingham, Ala.

1—The causes of knocks experienced when using low grade fuel in a high compression engine have not been accurately determined. There are several theories regarding its cause and origin, but none have been proven conclusively. From the number of complaints and discussions heard today about such things as knocking and pre-ignition, one would almost think that the greatest difficulty in present-day carbureting engines is to keep the charge from igniting too early.

It actually has been seen that the more volatile fuels require higher temperatures for inflammation in the air mixtures than do the less volatile ones. If attempts were made to ignite a volatile gasoline by heat of compression only, compression as high as 500 to 600 pounds might be needed.

Yet designers of kerosene engines have found it necessary either to prevent preignition by water injections or to keep the compression down to 50 or 60 pounds. As the proposition of gasoline is developing today there is a tendency to reduce the compression even for gasoline engines towards lower values in order that dissatisfied customers may be avoided.

One of the main sources of knocking lies in the regular ignition system, and the trouble may not be too early ignition but rather impartial ignition. The difference in the molecular structure of the heavier petroleum hydrocarbon and the molecular structure of the low end point gasoline accounts in a great measure for the knock experienced.

One of the theories along this line is as follows: The molecules of the heavier petroleum hydrocarbon are, so to speak, more loose-jointed than those of the lighter one. The atoms are strung together on long, snaky chains. By the agitation incident to ignition these chains are easily shaken to shreds and in the general breakup of the structure the oxygen finds ready points of attack.

This easier ignitability of the heavier hydro-carbons would at first sight appear to be only an advantage, if the fuel mixture at the instant of ignition were uniform and homogenously heated throughout.

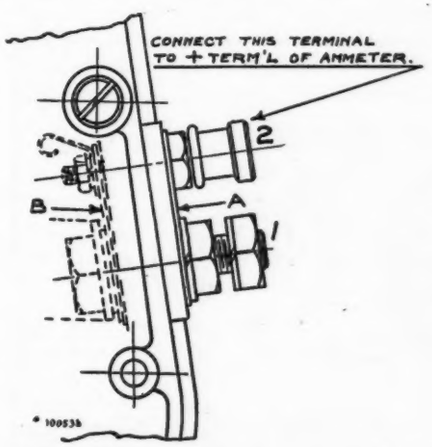
With the heavier fuels, however, the mixture is apt to lack uniformity. There may be certain pockets here and there where an especially ignitable mixture occurs. It is possible also that the fuel mixture adjacent to certain parts of the combustion space has become more heated than others. When ignition takes place the flame may at first spread quite slowly from the spark plug to the combustion space, but the instant it strikes a pocket of readily ignitable or overheated charge, this part of the charge may all at once be brought to the point of inflammation and be touched off almost explosively.

A considerable local pressure rise takes place before the adjacent cooler mixture parts have time to recede. This local superpressure dashes through the combustion space like a wave, hitting walls, rebounding and setting up sounds of detonation, in other words causing a knock. Those who have been engaged in research work on this phenomenon also have found that the position of the spark plugs have much to do with this knocking. From the results of considerable research work done at the Bureau of Standards it appears that the velocity of flame propagation is of a magnitude of 21 ft. per second at distances of about 1 inch from the spark plug.

The velocity becomes greater as the flame proceeds and is about 41 ft. per second over distances 4 inches from the spark plug. It is desirable to have the combustion completed in a little more than 1-10 revolution of the crankshaft or at medium engine speeds about 5-1000 of a second. In this short time the flame according to the investigation just referred to, travels only 1 to 2 in. from the spark plug.

This means that unless the spark plug is located right in the middle of the cylinder head and the combustion space is very thin the flame will not spread through the cylinder or combustion space in the time desired. Now if two spark plugs be located on opposite sides of the combustion space the flames from the two plugs will travel against each other and will most probably impinge on each other and increase the inflammation before they reach the detonation stage.

It has been found that in an L-head truck engine knocking badly at 500 r.p.m. that all knocking was supressed instantly when a second spark plug was put into action. The timing of the spark also has considerable influence on this. Some of the immediate cures for knocking are the use of a hot-spot on the intake manifold, high test gasoline or reduction in the compression ratio. The latter, of course, should be avoided unless absolutely necessary. Certain anti knock mixtures are available. They are benzol, iodine and diethyl-telluride.




Method of installing an ammeter in the Delco system as recommended by that company

## ATTACHING AMMETER ON BUICK

Q—Advise just how to attach ammeter on Buick model B-25 1914 model. Bunton & Berg, West Union, Iowa.

If it is desired to install an ammeter in connection with this system the following procedure is recommended by the Delco company. Referring to sketch it will be noted that a brass strap connects the two terminals No. 1 and 2. On some of the machines this strap is inside of the frame as indicated by the letter B and on others on the outside as in A.

If this strap is on the inside of the motor generator it will be necessary to remove the motor-generator from the car and take it apart to cut the strap. When the strap is on the outside as in A it can be cut with a hack saw without removing the motor-generator from the car. The negative terminal of the storage battery should, however, be disconnected before attempting to cut.

After the strap is cut the leads attached to the two ammeter terminals should be connected to the two terminals previously connected by the brass strap. In all cases the leads originally connected to these two terminals must remain undisturbed. The installation of the ammeter requires that the two additional leads must be attached to the motor-generator terminal.

Should it be found that the ammeter indicates discharge instead of charge simply reverse the connections at the back of the ammeter. For such installation it is recommended that the meter be of the "dead beat" type having a zero center and approximately 30 amperes charge and discharge scale. The meter connected in this manner will indicate the net charging current but will not indicate the discharge current taken by the motor during the cranking operation.

## FOUR TO ONE GEARS ON 1919 MAXWELL

Q—Advise if it would be practicable to install four to one spiral ring gears and pinion in 1919 Maxwell roadster in place of the present 3.58 to one gear. Also advise where such gears may be secured.—Geo. W. Owens, Dodge Service, Dowagiac, Mich.

Four to one gears will reduce the speed of the car but give more power or hill climbing ability. Also if there is any tendency for the engine to vibrate at any certain speed it will reduce the car speed at which this vibration will take place. Unless the car has to meet unusual hill climbing conditions we would hardly think the change advisable. Names of concerns from which gears can be obtained are furnished by letter.

## U. S. L. GENERATOR AND STARTER

Q—Publish a sectional view of the U. S. L. generator and starter as fitted to the Mercer car, and show how generator and armature is removed. Advance Auto Service Co., Newark, N. J.

A chassis layout of the Mercer 22 series is shown below. The alignment joints must first be unbolted, then remove brake rod and interlocking transmission rod. This is the rod on the left side of the clutch driveshaft directly to the left of the transmission shaft or shaft running from clutch to transmission. Take out clutch and flywheel bell housing by unbolting cap screws or bolts shown in chassis drawing.

To remove brush ring take out six machine screws, three on top and three on bottom. Take cover off of starter switch. Then disconnect two leads on top of brush ring. Brush ring can then be removed. Remove 12 ⅜-in. bolts around commutator on the armature, this will allow the armature to be pulled out.

If trouble is experienced in dislodging armature due to its tight fit on clutch drum, then select two of the 12⅜ in. bolt holes (which take the long driving bolts) opposite holes of course, and tap these 7/16 in. so that studs may be let in and a bar let across them which would form a puller of the conventional style. When this puller is used the armature may be drawn off without any danger as when pried off.

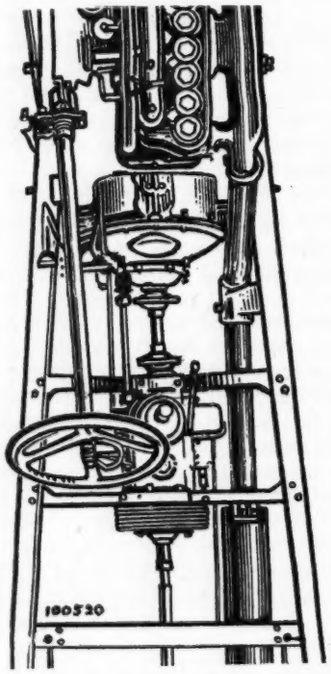
Remove all lighting and starting wires from starter switch. Remove two ½-in. cap screws at bottom of crankcase and also back of field and two in front that go through field from the front side. This will allow the entire assembly to be removed. View showing the three major parts of the U. S. L. assembly are also shown below.

## REMOVING CAKED GREASE FROM SHOP FLOOR

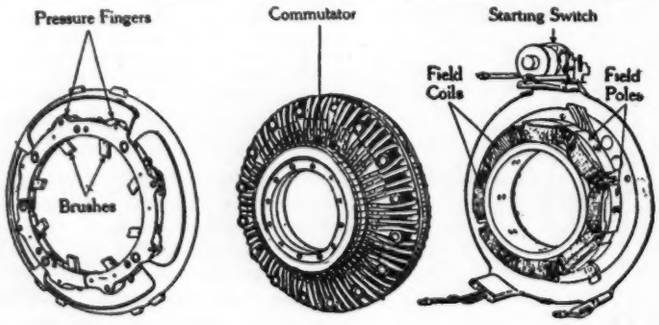
Q—A 1920-490 Chevrolet has a very small oil pipe leading to the center main bearing. If a larger pipe were installed in place of the small one would this change the reading of the oil gage?

1—Installation of a larger diameter pipe would cause a drop in the pressure reading on this system. Such a procedure is not advised by the local Chevrolet maintenance station. The burning out of bearings in this model engine is usually due to dirt getting into the oil. For this reason we would advise that you pay particular attention to the condition of the strainer of the oil pump and would also advise that you do not refill the crankcase with oil until it has been strained through a fine mesh screen. We would also recommend that the center bearing feed pipe be cleaned approximately every 2,000 miles of running.

This can be easily done without disturbing any internal parts of the engine. Also make sure that the oil pressure gage is reading somewhere near the maximum pressure required. In case the pressure does not reach the desired value we would recommend that the pump be carefully examined and if the gears show the very slightest wear they should be replaced.




Chassis layout showing flywheel housing which covers U. S. L. starting and lighting system




100520 Brush Rig — Armature — Field and Starting Switch

Three component parts of U. S. L. system as applied to Mercer "22" Series

2—Tell me how to remove the hard grease and dirt packed on the shop floors? Is there some liquid to use?

2—One of the special solutions of Oakite will remove this grease and dirt that you speak of. The solution is manufactured in three different grades for use on the different kinds of floors, and we would advise that you communicate with the Oakley Chemical Co., Chicago, Ill., who will recommend the proper solution to solve your particular problem.

3—What tools would you suggest as best for measuring by thousandths the inside of cylinders and the outside of pistons?

3—The conventional inside micrometer is perhaps the best instrument in common use today for accurately measuring the inside of cylinders. The outside micrometer holds the same position in accurately gaging the outside diameter of pistons. The dial indicator is of great value in reading the size of cylinders and should be used in conjunction with the micrometer as its readings are only comparative, but it is very valuable to determine out of round condition of cylinders and variation in size of one bore to another.

4—Will you send questions that a chauffeur must answer to obtain license? —Ray E. Gould, Dodge Center, Minn.

4—The questions which are asked regarding a chauffeur's license vary with the different states. Some states do not require a written examination and therefore there are no particular questions asked the applicant. A few clauses from the examination in licensing chauffeurs law of the state of Minnesota section 26 to 38. There is hereby created a board of automobile examiners of three members to be designated by the governor, who shall be men possessing a technical and practical knowledge of the construction, mechanism and operation of motor vehicles, whose term in office shall be for two years. Said members are to receive a compensation of $5 per day and actual expenses while in session and all traveling expenses.

It shall be the duty of said board to conduct the examination of all applicants for chauffeurs, licenses herein provided for at such time and such places as shall be designated by the secretary of state; to pass upon the qualifications of such applicants and to issue to those having a practical knowledge of the construction, mechanism and operation of motor vehicles, the license to be known as chauffeur's license, provided that no such license shall be issued to any person under 18 years of age or who is an habitual and excessive user of intoxicating liquors or to any person of defective eyesight or other physical infirmity, which in the judgment of said board renders such person incompetent to manage and care for a motor vehicle. We would suggest that you communicate with Mike Holm, Secretary of State of Minnesota.

# How to Install a Backing Light

Q—Publish drawing of switch and circuit used on Wills Sainte-Claire car for operating the rear light used when the car is in reverse.—M. C. Waters, Brookfield, Mo.

We have but little information on this system but show herewith a circuit diagram which is applicable to most any car. The wire from the tail light terminal on the lighting switch goes to both the tail light and one terminal of the backing light while the other terminal of the backing light goes to a piece of spring brass mounted on a fibre block in such a way that the gearshift lever will strike the piece of spring brass while in reverse position only.

This will complete the circuits to ground and operate the backing light. The only possible objection this might have would be fire hazard in case slight sparking at the switch should come in contact with gasoline. An improvement would be to use a push button switch like an ordinary door bell mounted on a piece of wood or fibre so that the gearshift lever would push the button.

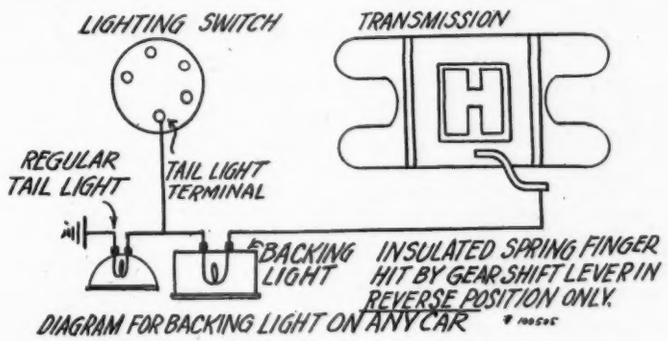


DIAGRAM FOR BACKING LIGHT ON ANY CAR

## LEAN MIXTURES PREVENT FAST COMBUSTION

Q—What will cause a car to pop or spit in the carbureter when the mixture is lean? Is it because the gas burns slowly and fires back through the carbureter on the next suction stroke?

1—Slow burning of the gas when the mixture is too lean is the cause of popping back in the carbureter, as the cylinder still contains some flame when the next suction stroke takes place and this flame fires the incoming mixture.

2—Does the use of alternating current in an ignition coil also change the direction of the secondary current? If so, why does the secondary current continue to jump in the same direction across the spark gap?

2—The direction of voltage in the secondary and therefore the direction of the secondary spark changes whenever there is a change in the primary current. This is true of any high tension magneto of standard construction. On a Bosch high tension magneto, for example, the spark at the number one plug might jump from the center electrode to the engine, while on the next cylinder to fire it would jump from the engine to the center electrode.

This difference, however, has no appreciable effect on the operation of an engine. In regard to the ability of the secondary spark to jump in either direction we might compare this to the ability of a man to jump across a ditch where assuming the banks are similar it would be as easy for him to jump from the east side to the west side as from the west side to the east side.

In similar manner there is no appreciable difference in the ability of the spark to jump either to or from the engine assuming that the shape of the spark plug points is similar.

3—When a battery has been connected the wrong way with respect to a generator will it cause the battery to discharge until the polarity of the generator reverses?

3—In connecting a battery the wrong way to a generator two different conditions will be encountered depending on the weight of the moving arm in the cut-out or relay. If there is some weight or inertia to the moving contact arm, sufficient discharge current will flow from the battery to reverse the residual magnetism in the generator and with this reverse the generator polarity will also reverse so that charging current will then begin to flow and everything will be all right except that on a car the ammeter will show discharge when it really means charge.

On other cut-outs or relays where the moving arm is quicker, a vibrating action will take place at the cut-out points which will be too fast to allow the generator residual magnetism to be reversed by the battery current. Under such circumstances destructive arcing will take place at the cut-out contacts which, of course, causes considerable trouble. In such circumstances, however, if the cut-out has been closed by hand so as to first magnetize the generator fields in the proper direction, no further trouble will be encountered.

4—Will a Zenith carbureter as used on a Chevrolet 490 be all right on a Ford with a Rajo overhead valve type of head? This is the stock car head.—W. E. Hollenbeck, Lentner, Mo.

4—The Zenith carbureter as used on the Chevrolet 490 will be all right on the Ford with the stock Rajo overhead valve head as far as carburetion is concerned. The flange however, on this Chevrolet carbureter is not exactly suitable as the bolt holes are located, one toward the radiator and one toward the rear of the car, while the manifold that comes with the Rajo head has the bolt holes one toward the engine and one toward the outside of the car.

If you already have one of these Zenith carbureters and wish to use it, it may be possible to make the necessary changes so that suitable connections can be made. However, if you are figuring on purchasing a carbureter for this job, the Zenith people put out a special carbureter which is their number S4BS which is exactly adapted to this purpose.

## OAKLAND STRAIGHT TWELVE

Q—Could two model 32 Oakland engines be coupled tandem with any degree of success? If so, would I have twice as much power and snap or what per cent?

1—The coupling of these two engines in tandem would give power to the sum of their individual h. p., so that if one model 32 engine delivers 42 h. p. the total h. p. of the two engines will be 84 approximately.

2—What would be the best speed obtainable in r. p. m., of such a plant? Could the gear ratio be cut down in proportion?

2—Such construction will cause only a slight gain in revolutions, but the added power will enable you to decrease the gear reduction. The speed obtainable would depend entirely upon the construction of the car as a whole. If the car weighs under 1600 pounds and is well balanced and the proper gear ratio is used it would be possible to secure a speed of over 90 m. p. h. The maximum revolutions of the regular 32 engine are approximately 2900 to 3000 r. p. m.

3—To what extent are the E. C. L. aluminum alloy non-expanding pistons non-expanding? In other words, would said pistons give satisfactory results at high speeds when fitted at .025 or .003?

3—The non-expanding type of aluminum piston can be fitted with approximately the same clearance as a cast iron piston due to the fact that the high coefficient of expansion of the aluminum is taken care of by slots in the skirt of the piston which cause the material of the piston to close in when the piston becomes heated. This type piston will give satisfactory results for high speed work.

4—In constructing a speedster in order to keep the necessary weight on the ground, would it be advisable to use heavy wheels or would they hinder a quick getaway?

4—Under no circumstances should the weight of the wheels be increased as this would cause great difficulty in overcoming inertia of these parts and acceleration would be very poor. The thing to watch is to secure a good balance of the entire chassis, securing if possible approximately the same weight on each of the four wheels. If the chassis is well balanced and is equipped with fairly flat springs and shock absorbers there should be no difficulty in keeping the car on the ground at high speed.

5—Give names of firms that could furnish high speed differential gears for above car.—D. G. Wiebe, Austin, Texas.

5—This will be answered by letter.

# Correct Setting of Ford Brushes

Q—What causes current to jump from generator to engine mud pan when racing engine on a Ford?

1—As far as we can figure current jumping from the generator of a Ford to the mud pan is an electrical impossibility, as the generator is grounded to the engine by means of the three bolts which hold it on and the mud pan is also grounded to the engine by the bolts which attach it to the engine and when two things are grounded or connected to the same thing there can be no voltage difference between them and consequently, no current jumping from one to the other. We think that possibly you may have a headlamp wire or possibly one of the wires which go to the timer in such a condition that the insulation is rubbed from it and a spark from this wire may be jumping to the engine mud pan.

2—Give complete instructions for setting brushes on Ford generator.

2—The main brushes should first be set by connecting a battery to the live terminal of the generator and also to the frame of the generator with the third brush lifted. This will give battery current to the armature only and the correct main brush setting is obtained when there is no appreciable tendency for the armature to rotate in either direction. To shift the main brushes it is only necessary to loosen the four screws which show up at the commutator end bracket and these permit shifting the whole rocker ring which carries the main brushes. After brush position has been obtained which gives no appreciable tendency for the armature to turn in either direction these four screws should be tightened and the third brush can then be replaced on the commutator.

When the generator is then tested, either on a test bench or on the car the third brush can be adjusted to give the desired output which will vary somewhat with the requirement of the owner and with the temperature, being approximately 10 amperes in summer and 15 amperes in winter. In shifting the third brush care should be taken that the little locking nut is first loosened for if this is not done and the brush is forced in either direction, it is most likely to injure the insulation of the rocker ring which will require taking the generator all apart again and putting in a new rocker ring. After the third brush has been put in the proper location this locking nut should, of course, be tightened again.

3—Do you think it is possible to charge lighting and ignition storage battery with Ford magneto when using the device known as a battery charger in connection with magneto?

3—We are not sufficiently familiar with devices of this kind to be able to give an unqualified recommendation of any of them, although, of course, it is possible that there are some unknown to us which give satisfactory service.

4—Would such an attachment weaken the magneto?

4—Whether the Ford magneto would be weakened or not depends on the amount of current used by such a device, but we do not believe you would have any trouble from this score, as the magneto now being used is capable of operating headlamps which draw considerable current.

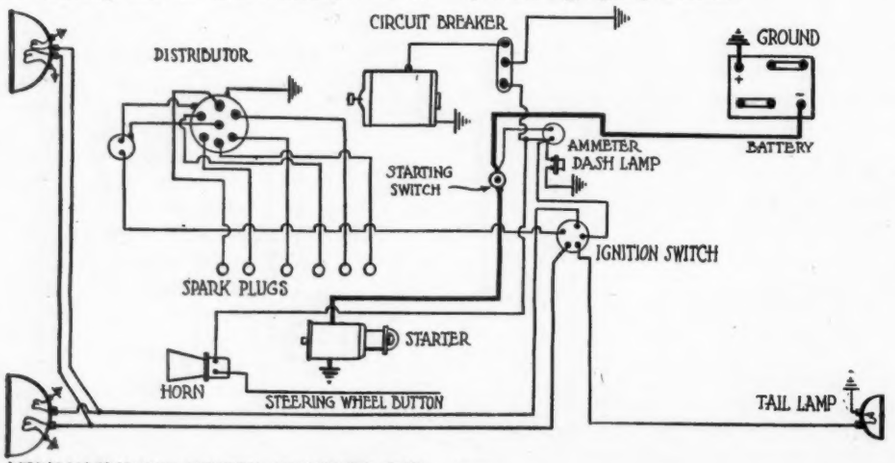
5—Give the addresses of concerns manufacturing or selling a successful hotspot manifold for the Ford.—Ed. O. G. Paulus, Random Lake, Wis.

5—This information will be given by letter.

### NOISE IN BUICK D-44

Q—We have a six cylinder Buick roadster 1917 Model D44 which has been run about 30,000 miles. On starting the car and opening the throttle there is a decided growl which we believe to be in the gears in the rear axle. There is plenty of heavy oil and always has been in both the transmission and differential. The gears have been examined and from all appearances seem to be in good condition. What is likely to be the cause of this noise?—Geo. S. Hawes, Detroit, Mich.

While the surface of the gear teeth may be in good condition it is quite likely that the annular ball bearing which supports the pinion is badly worn which is quite likely considering the mileage attained by this car. This would permit the thrust between the gears when starting to force the pinion out of mesh to a certain degree in which case the action of the teeth would be noisy as gears do not usually run quietly unless properly meshed. After the car has attained a certain speed the power and torque required are less than in starting up and the thrust is therefore, less which probably accounts for the reduction in noise under these circumstances. We would therefore, suggest that you inspect the condition of this bearing and if appreciably worn would advise putting in a new one.




WIRING DIAGRAM 1921 COLUMBIA CHALLENGER MODEL.

### MYSTERIOUS RADIATOR LEAK IN OVERLAND 90

Q—Advise what is wrong with engine of Overland 90. It has following symptoms. The owner of this car has never allowed it to become frozen and always had plenty of denatured alcohol in the radiator at all times. Nevertheless, every 15 days the oil pan accumulates about ½ of its capacity of water. We have tested the cylinder block with 125 pounds of air pressure but have been unable to detect a leak. Suggest a remedy.—Ross Arbuckle Garage, Iola Kansas.

After carefully reading your letter we have come to the opinion that you have given the cylinder block about every available test that is possible. Your tests have been very thorough and anything that we say is merely in the matter in the way of a suggestion. First we would suggest that you ask the owner to fill the radiator completely with water and after having drained out all of the water from the crankcase and refilled with new oil have him operate the car for perhaps 10 or 15 days and note whether the water in the radiator falls below the original level.

If there are no leaks in the hose or in the radiator or any of the water lines and the water level shows an appreciable drop such as two and one-half quarts which would be the capacity of half of the sump it would be conclusive proof that the block was leaking although you are unable to detect it. But if after having filled the radiator to capacity and the car is operated for a period of 10 or 15 days the level remains substantially the same it is a conclusive proof that the cylinder block is not leaking and that the trouble is caused either from an oil which carries an amount of water in suspension or from condensation from the gasoline. If there is not any unusual loss of water from the radiator it would be well to try a different kind of oil as the first test.

If a different oil fails to stop the accumulation of water we would suggest that you try high test gasoline. However, the gasoline condensation theory is sort of far fetched because we doubt whether sufficient condensation would take place to cause the amount of water that you have experienced.

### WIRING DIAGRAM OF 1921 COLUMBIA

Q—Give wiring diagram of 1921 Columbia car Challenge model.

1—Wiring diagram of the 1921 Columbia car Challenger model is shown at left.

2—What Columbia car has Rutenber engine No. 49999.

2—Rutenber motor No. 49999 was used in Columbia Sport car No. 10875.

# Oiling, Wiring and Carburetion on 3-48 Packard

Q—We have a Packard 1914 engine No. 51055 six-cylinder. Is this a 1-48 model?

1—We are informed by the local Packard agency that this engine was installed in a model 3-48.

2—Publish wiring diagram for both Bosch dual magnetos. Would like wiring diagram for starting and lighting on this car.

2—Diagram showing the lighting and starting installation is shown in Fig. 3, also the wiring of the Bosch dual magneto is included in this same diagram. You will note that this 3-48 Delco system utilizes the mercury type of regulator. This type regulator can be replaced by the Bijur regulator which was used on somewhat later models, this, however, requires changes in the internal wiring of generator.

3—Publish illustration of carbureter and give adjustment.

3—There are no adjustments on the Packard carbureter except for the air or auxiliary adjustment. An illustration of this carbureter is shown in Fig. 4. The auxiliary air valve is in a cage on the other side of the carbureter and is controlled by the tension of two springs, one of which is within the other. The wedge underneath the springs regulates the tensions of the springs and adjusts the action of the valves and this wedge is connected with auxiliary air valve hand wheel on the control board.

Turning the air valve hand wheel toward "Gas" provides a rich mixture; turning it toward "Air" provides a rare mixture. The auxiliary air valve stem should be cleaned frequently with gasoline, so that it will always work freely. An adjustable stop holds the throttle valve slightly open and thus allows a small amount of mixture to reach the motor cylinders, even when the hand throttle on the wheel is entirely closed. To increase this minimum speed, loosen the check-nut and screw the stop forward. To decrease the speed, screw the stop backward.

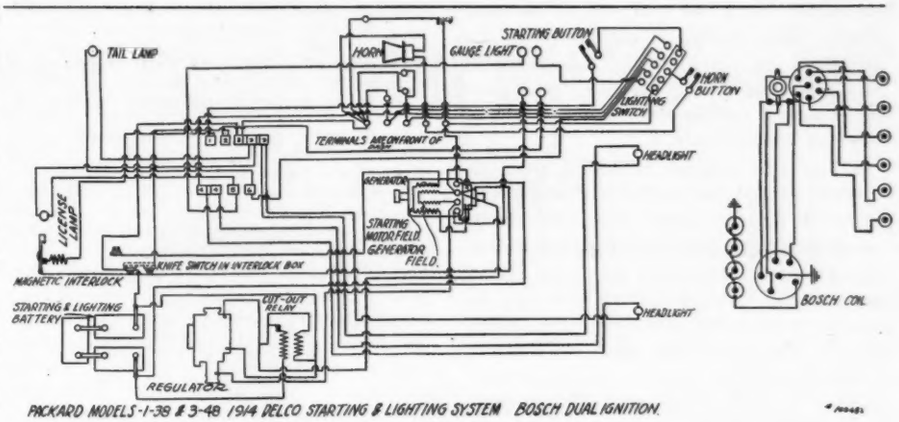



Fig. 3

The adjustments to the carbureter air valve spring are made with the air valve control wheel on the steering column sitting with the small button on the wheel directly opposite the standard button on the wheel bracket. With control wheel in this position the low speed spring should just hold the air valve in contact with its seat, engine not running, and there should be a distance of 5-32 of an inch between the inner high speed spring and the air valve stem nut.

4—Publish diagram of oiling system.—A. Schirmer, Jr., Cincinnati, Ohio.

4—The diagram of the oiling system is shown in Fig. 5. The cylinders, connecting rods, crankshaft bearings, camshafts and all parts within the crankcase and cylinders are lubricated directly or indirectly by a forced feed oiling system. The circuit of this oiling system is as follows: The oil is pumped from the crankcase reservoir through the hollow camshaft which acts as a distributing manifold. The oil is distributed from the camshaft through the camshaft bearings to each of the main bearings.

The crankshaft is provided with oil ducts which carry oil under pressure to the lower connecting rod bearings. The oil then continues under pressure, through copper tubes to the piston pin bearings. Baffle plates limit the amount of spray from the lower connecting rod bearings reaching the cylinder walls to the amount needed for light running.

When the engine is under a heavy load the auxiliary system provides for the increased oil requirements of the cylinders. The front end bearings are lubricated by pressure from the strainer housing. All the overflow from the relief valve flows down and lubricates the front end gears. There are sediment pockets in front and at the rear of the oil pump. The oil is strained before it enters the pump and again is strained before it enters the camshaft. Two baffle partitions are located in the bottom of the crankcase, to prevent splashing of oil in oil well.

The auxiliary oiling system for the lubrication of the piston and cylinder walls when the engine is under heavy load, enters through the cylinder walls on the right side. This system obtains

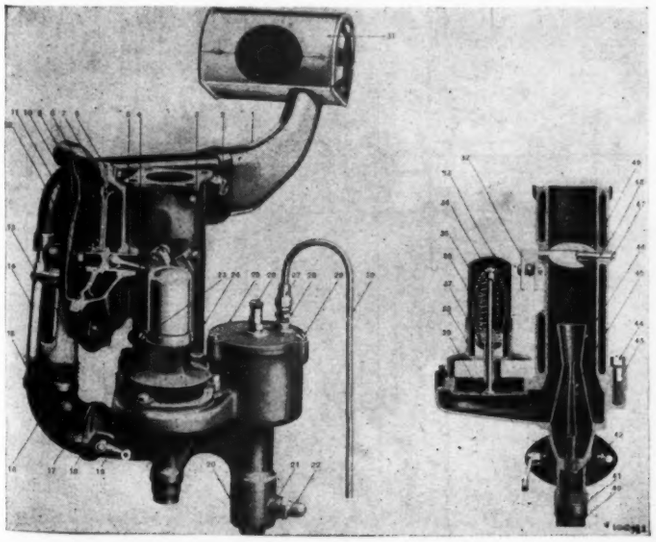


Fig. 4—Section through Packard carbureter showing cutaway view at right of air valve assembly

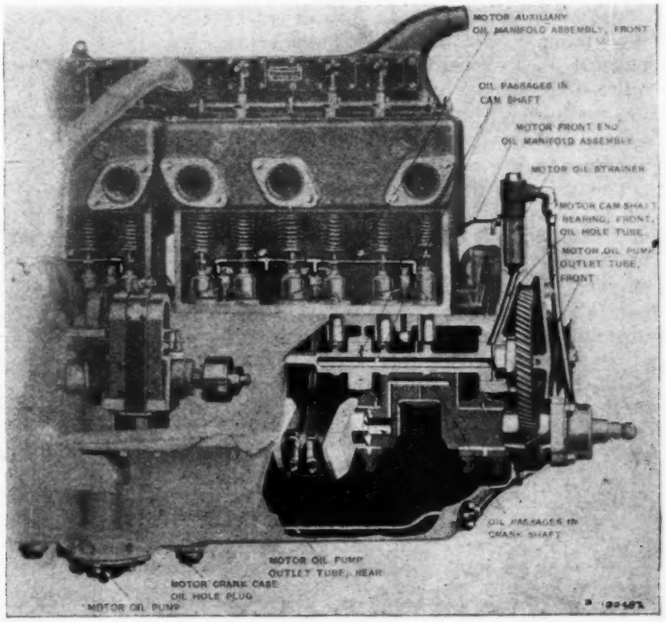



Fig. 5—Partial cutaway of Packard 3-48 engine to show oil passages in drilled crankshaft

its supply from the rear end of the camshaft. This system is controlled by the auxiliary oil valve, which is automatically operated by the throttle. The valve is attached to the rear of the crankcase on the left side.

When the engine is idling and the throttle closed, the cylinder walls are lubricated by the spray from the lower connecting rod bearings and from overflow from the piston pin bearings. When the throttle is opened one-third way the auxiliary oil valve starts to open, allowing oil under pressure to enter the auxiliary oil leads.

The oil then lubricates the cylinder and piston walls under pressure, the amount increasing with the throttle opening. An oil reservoir is formed by the lower section of the crankcase. It should be filled with cylinder oil to the level of the pet cock on the left side of the motor.

The motor oil pump is a gear pump located at the lowest point of the crankcase oil reservoir and it forces the oil through the main feed pipe in the bottom of the crankcase to the camshaft. This pump may be removed for cleaning or inspection by removing nuts which hold it to the bottom of the crankcase. The oil strainer and relief valve assembly is located at the front of the engine above the front end gears.

The oil enters from the oil pump and passes through the strainer before it enters the relief valve. Relief valve is controlled by a spring and should be set to show five or six pounds pressure when engine is warm and idling. This valve prevents excessive pressure in the system. Before the oil enters the camshaft for distribution there is a basket strainer to free the oil from dirt. Every two weeks or every 500 miles, the strainer should be cleaned. To remove, unscrew the cover and lift out the strainer. There is also a strainer in the bottom of the crankcase to the camshaft. This covers the entrance to the oil pump.

The oil is thus strained before it enters the pump. The strainer should be cleaned once every month or every 1000 miles. It may be removed easily when the tumble bolt on the left side of lower section of the crankcase is released by unscrewing the holding nut.

The gage on the dashboard shows the oil pressure in the manifold. The normal running pressure is from five to six pounds, depending on the speed of the engine. The supply of oil is obtained by pouring oil directly into the crankcase through the crankcase vent at the left of the engine. This crankcase should be filled to the pet cock level. The pet cock is operated by a rod coming through the crankcase web in front of the carbureter.

## WIRING SYSTEM OF OVERLAND 85-SIX

Publish wiring diagram of Overland model 85 six cylinder.—Wm. Barkla, Dalkena, Wash.

The diagram of this car is shown in Fig. 7.

## FACTS CONCERNING 1917 STUDEBAKER

Q—Publish valve timing diagram of Studebaker 1917, model E D 6.

2—What is the firing order of this engine?

3—What is the valve clearance?

4—What are the gear ratios, in first, second and third speed?

5—Publish power curve of this engine.

6—Can the starting motor on this car be run on alternating current of 6-volts? —A. R. Wilson, Chicago, Ill.

1—The valve timing is as follows: Intake closes 32½ degs. after lower dead center, intake opens 12½ degs. after upper dead center, exhaust opens 45 degs. before bottom dead center, exhaust closes 7½ degs. after upper dead center. To time the engine it is necessary to set the exhaust valve. 7 degs. on the Studebaker flywheel equals 1-11/64 in. of flywheel travel, after upper dead center when the exhaust valve closes.

2—1-5-3-6-2-4.

3—.003 to .004.

4—The gear ratio of the Six in first speed is 13.05 to 1, in second speed 7.41 to 1 in reverse 17.69 to 1. The rear axle reduction ratio is 3.71 to 1.

5—This is not available.

6—No.

## GEAR RATIO OF TWO-SPEED CADILLAC

Q—We have a 1914 model Cadillac car that we wish to convert into a sort of runabout and would like your advice on the following:

1—Give us bore, stroke and displacement.

2—This car has two speed axle, advise gear ratio.

3—Would you advise reducing wheel size to 32 or 33 in. instead of present 36 in. size? This is for a somewhat hilly country.

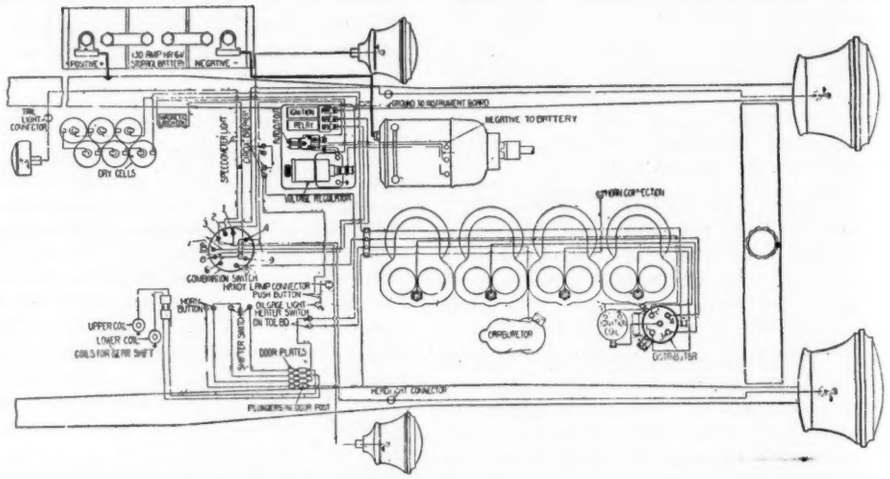
4—Publishing wiring diagram for this car.—P. H. Remington, Waynesboro, Pa.

1—Bore 4.5 in., stroke 5.75 in. Displacement 365.8 cu. in.

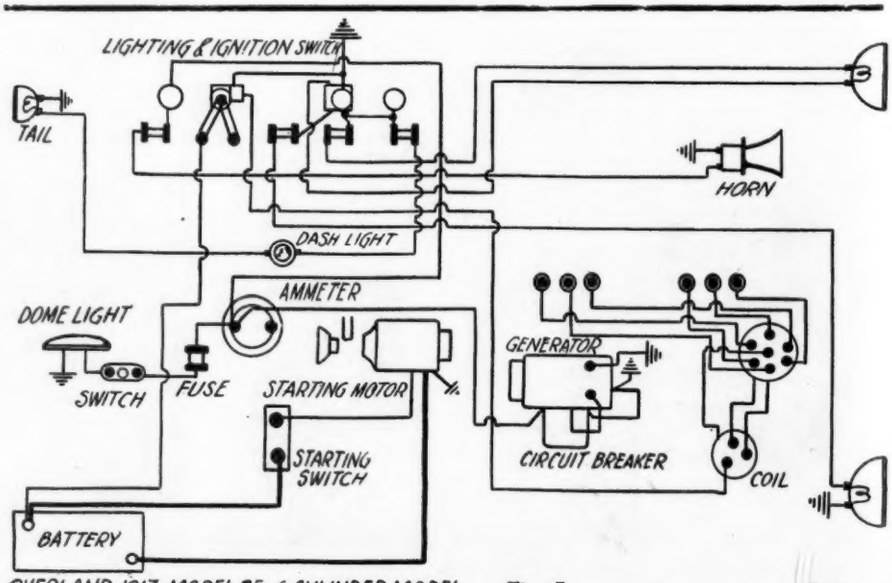
2—Gear ratios in axles are 2.5 to 1 and 3.66 to 1.

3—We believe that with the two-gear ratios available in the rear axle the car should negotiate practically any hill, assuming, of course, that the gear ratios available in the transmission are used with discretion. Of course, if you find car somewhat sluggish on hill it will help to reduce size of wheels, as you suggest.

4—Diagram is shown in Fig. 6.




1914 CADILLAC WIRING. 100476 Fig. 6




OVERLAND 1917 MODEL 85-6 CYLINDER MODEL Fig. 7

# The ACCESSORY SHOW CASE

## New Sources of Retail Profit

### SCIENTIFIC Z SPARK PLUG

Scientific Z Spark plug shells and gland nuts are turned from bars of carbon steel. The gaskets are of copper and the insulators made of "775" material, used in airplane plugs. Price 85 cents to $1.25. Geo. T. Simmons, Janesville, Wis.

### ALTA SHOCK ABSORBER

Each Alta spring contains 46½ inches of the finest heat-treated chrome vanadium steel, and there are four to the set, thus giving the car 15½ feet additional spring value. Set of two, $18. Alta Co., 417 Market St., San Francisco.

### LION LOCK STEERING WHEEL FOR FORDS

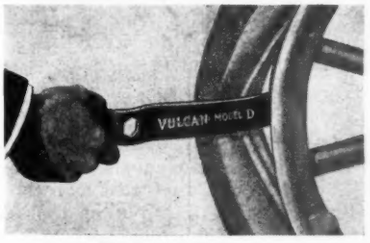
The Lion Lock steering wheel for Fords, includes a 17 in. oversize steering wheel and can be attached in 15 minutes. Price $10. Lion Lock Steering Wheel Co., Haverhill, Mass.

### MULTOMATIC SAFETY SIGNAL

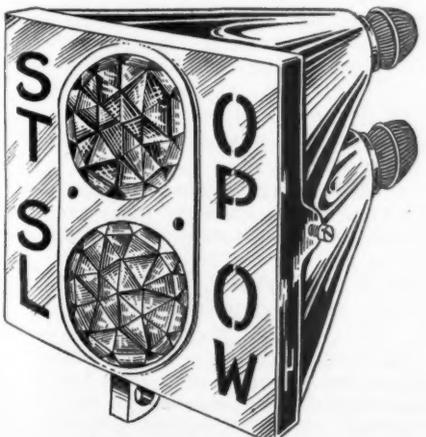
Multomatic safety signal is made of cast aluminum and is highly polished. J. L. Sparks Brass Works, 1723 Carroll Ave., Chicago.

### VULCAN RIM WRENCH & TIRE TOOL

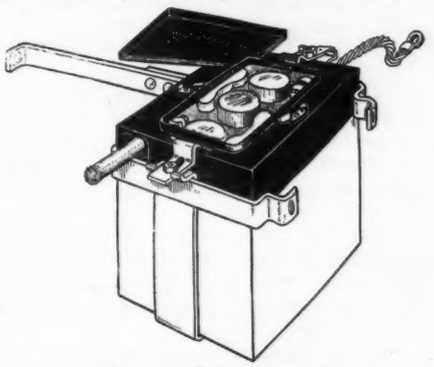
The Vulcan rim wrench and tire tool is made with two sizes of spanner holes, making it possible to use on all rims, including Ford. It can also be used to remove tires from rim or wheel. Jenkins Vulcan Spring Co., Richmond, Ind.



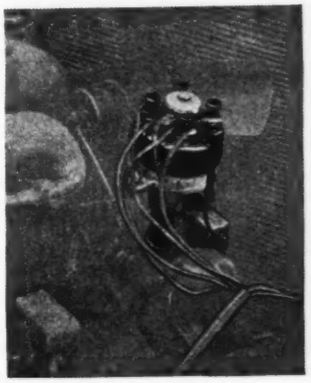

Vulcan rim wrench and tire tool



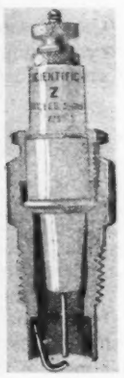

Multomatic safety signal



Protecto battery cover

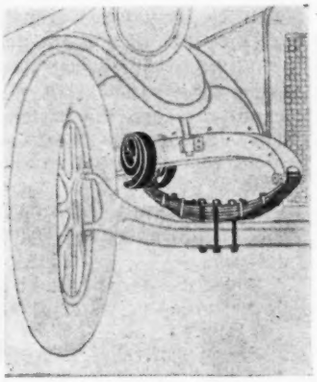


Mallory timer

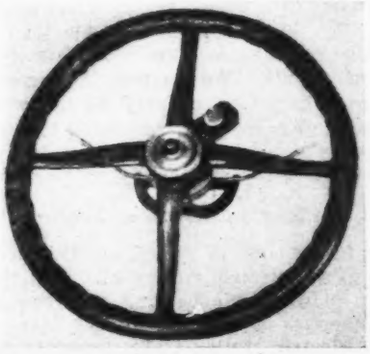


Scientific Z spark plug


Greaserite pressure lubricating system



Alta shock absorber



Lion lock steering wheel for Fords

### PROTECTO BATTERY COVER

The Protecto battery cover is made of heavy steel metal, acid proofed and insulated to guard against short circuits. It is attached with regular battery clamps, covers the entire top of the battery and extends down the side, affording ventilation. Price, $1.50. Protecto Mfg. Co., Brantwood, Wis.

### MALLORY TIMER

The Mallory timer eliminates vibrating points on timer. A. R. Pollasky Co., Milwaukee, Wis.

### GREASERITE PRESSURE LUBRICATING SYSTEM

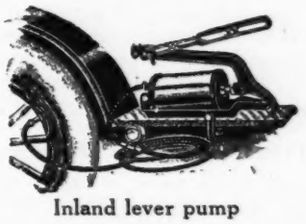
This greasing system is operated by air, has a capacity of 70 lbs. and is equipped with an automatic double action measuring device. Greaserite Mfg. Co., 608 S. Dearborn St., Chicago.

### BERGEN CARBURETER

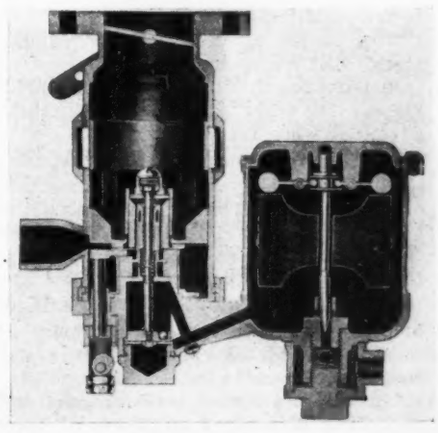
The Bergen carbureter is an automatic type, having only one adjustment and containing no springs, cams, gears, or linkages. Built in all sizes by the B. & P. Carbureter Co., 57 Hope St., Brooklyn, N. Y.

### INLAND LEVER PUMP

The Inland lever pump attaches to the running board and is fitted with a hose which extends to the tire and is pumped by hand. Price, $6.50 Universal Mfg. & Sales Co., 552 W. Harrison St., Chicago.



Inland lever pump



Bergen carbureter

# *Rapid Development of Transportation in Past Few Years As Compared With Past Centuries*

## The Makers and Sellers of Motor Vehicles Are Important Contributors to the World's Progress

GEORGE M. GRAHAM of the Highways Committee, National Automobile Chamber of Commerce, speaking on "The Highways, the Motor Vehicle and Progress" said with relation to the development of transportation:

"As a background, I should like to draw you a rapid picture of transportation development.

"We, in this country, are great admirers of the pioneer. We revere a Columbus or a Magellan. We thrill at the courage of the Lewis-Clark expedition, but actually we do not carry our admiration far enough, because we seldom consider how inadequate were the mediums of transportation with which these men ventured over unchartered oceans or penetrated fathomless forests.

"Nothing in the world has been so slothful in its development as transportation.

"Ninety per cent of all the years that have elapsed since the birth of Christ saw in use the same primitive mediums of transportation that prevailed during his lifetime.

"In 1800 years the world has not advanced beyond the point of the man-hauled or the beast-hauled wagon or cart, or the man-propelled or wind-propelled boat. It is an amazing thought when set against all that happened in the world in that time.

"The culture of Greece, the far-flung power of Rome, the mighty empire of Charlemagne, all had their rise, their history and their fall. The Dark Ages and the Middle Ages came and went.

"In the fifteenth and sixteenth centuries came that great outburst of exploration that carried the mariners of Europe all over the world to the discovery of new countries.

### *Progress in Other Directions*

"Three great revolutions, in England in 1688, in our country in 1776, and in France in 1792, made their contributions to free institutions.

"Yet during all that long period, the world still clung to that same kind of transportation that the disciples of Christ knew. In other directions, marvelous advances were made.

"If the world was slow in transportation, it was not slow in the fundamentals of government. The Magna Charta, the great basis of all civil liberty, antedates the coming of a new kind of transportation by six centuries.

"The Declaration of Rights in England, and the Declaration of Independence in the United States, also antedate any transportation advance.

"Inventors achieved both for good and ill. They discovered gunpowder. They invented printing. They did nothing for transportation.

"The great art works of all times, paintings, statues, buildings, mountain peaks of human genius, all came to the world while transportation still depended upon the wind and upon the muscles of man and beast.

"Actually the history of modern transportation can be written within the last 120 years. The world has accomplished more in that interval than in 1800 years of prior Christian history.

"When Robert Fulton launched the Clermont on the Hudson, and when Stephenson two decades later invented the steam locomotive, they discounted everything that had gone before in the entire history of transportation.

### *The Internal Combustion Engine*

"Now, at the beginning of the twentieth century, we have also motor vehicle and aeroplane, depending upon internal combustion motors, gasoline driven, just as their predecessors depended upon steam and electricity.

"The aeroplane has not yet been perfected to the point of great commercial development, but the motor vehicle has gone so far that the President of the United States, in his first message, called attention to its dominating place in our political, social and industrial life.

"I should like to illustrate by figures relating to 1918, just how freight and passenger haulage is divided in our country among the various mediums. I have chosen 1918 because these are the most representative figures I have been able to obtain.

"In that year, 18,000 miles of interurban trolleys moved 4,000,000 tons of freight.

"Over the Great Lakes and Mississippi, 15,000 miles of waterways, went 90,000,000 tons.

Steam railways, over 259,000 miles of trackage, moved 2,504,000,000 tons.

"The motor truck, the baby of the quartet, carried 1,200,000,000 tons, a figure to some extent an estimate, but a conservative estimate.

"We do not think we can take the place of the steam railway in long distance hauls. We do not think we can move freight as cheaply as the waterways. We concede cheerfully the function of other mediums, but we do insist that our place be equally recognized.

### *Place of Electric Trolley*

"In respect to passenger transportation, the electric trolley has a dominating place in the hauling of urban passengers.

"Electric trolley traffic amounts yearly to 13,000,000,000 paid passengers and 3,000,000,000 transfer passengers.

"It is a remarkable fact that in spite of the increasing use of automobiles, the number of trolley rides per person is also increasing.

"The trolleys carry thirteen times as many passengers per year as the steam railways, the latter figure being 1,066,000,000.

"The automobile figures must, to some extent, be estimated, but allowing for 10,000,000 cars, used daily, on the average, by two and one-half persons, we get a result of 25,000,000 automobile riders daily, or approximately one-fourth of the population.

"Even this last statement does not show how widespread is the use of the automobile.

"It is a popular fallacy to look at the traffic congestion in city centers and think of the automobile as a city convenience.

"Actually, the city is a comparatively small user of automobiles.

"Seventy-two per cent of all the cars in this country are in points of 50,000 population or less. Fifty-two per cent are in points of 5,000 population or less. Thirty-three and one-third per cent are in villages and hamlets of 1,000 or less.

"Two-thirds of all the automobiles go into homes whose income is $4,000 yearly or less.

"Our estimates indicate that 60 per cent of all the use of passenger automobiles is a utility one, and that for some automobiles this figure mounts as high as 90 per cent.

### *Far-reaching Influence*

"The influence of motor vehicle transportation on the movement of the necessities of life, food, fuel, raw material and manufactured articles, is of increasing importance.

"The farm figures alone constitute impressive figures.

"Senator Capper says that the farms of the United States, together with their equipment represent an investment of $70,000,000,000. The Department of Agriculture has estimated that 134,400,000 tons of farm produce go over our highways yearly.

"Fuel is largely dependent upon motor vehicle transportation. More and more coal and oil, especially in retail distribution, are handled through motor trucks. Electric companies, to keep up their lines, are heavy users of trucks.

"Raw material, the ore from the mines, the lumber from the forests, the gravel from the pit, the cotton from the fields, are all largely transported by motor truck."

# COMING MOTOR EVENTS

## AUTOMOBILE SHOWS

| | | |
|---|---|---|
| Ashville, N. C. | Annual Show | May 9-22 |
| Williamson, W. Va. | Williamson Automobile D'lr's' Assn. | May 10-13 |
| Central City, Nebr. | Business Men's Club | May 24-27 |
| Hartford, Conn. | Connecticut Fair Grounds | Sept. 4- 9 |

## RACES

| | | |
|---|---|---|
| Indianapolis | 500-Mile International | May 30 |
| Tacoma, Wash. | Eleventh Annual Race | July 4 |
| Colo. Spgs., Colo. | Pike's Peak Race | Sept. 4 |
| San Carlos, Cal. | 500-Mile Armistice Day Race | Nov. 11 |

## CONVENTIONS

| | | |
|---|---|---|
| Detroit | Automobile Trade Assn. | May 9-10 |
| St. Louis | Am. Auto. Assn. Annual Meet. | May 22-23 |
| Colo. Spgs., Colo. | Automotive Equipment Assn. | June 19-24 |
| White Sul'r Spgs., W.Va. | S. A. E. Summer Meeting | June 20-24 |
| Olympia | Washington Automotive Trade Assn. | July 21-22 |

## FOREIGN SHOWS

| | | |
|---|---|---|
| Rio de Janiero | Automotive Exhibition | Sept., 1922 |
| Paris, France | Automobile Show | Oct., 4- 15 |

# *Prize Situation Promises Hot Rivalry in Decoration Day Classic At Indianopolis*

BY PAUL DUMAS

DIRECT factory entered cars are the exception this year, especially among the American entries. Many of the Duesenberg cars are directly owned by the men who drive them, while some others have been leased by the factory to the drivers, who are to pay for the car out of their winnings as per special contract. It is said that purse money acquired by any of the Chevrolet Bros. pilots will be their property. Both the Duesenberg and Frontenac shops are located in Indianapolis and will do everything possible to assist the drivers in preparing the cars to win. It is evident from this that there will be real rivalry between each and every contestant regardless of his affiliations.

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A Motor Age representative visited the shop of the Chevrolet Bros. recently. The two Fronty-Fords that have been entered by this firm are nearing completion, which gave him an opportunity to check up on some of the outstanding specifications of these little cars that have attracted so much attention.

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Regular Ford motor blocks and crankcases are employed in conjunction with the Fronty-Ford eight-valve head made by the Chevrolet Bros. The Ford transmission, main drive and differential, with the stock rear radius rods, are retained with the exception that special alloy axle driveshafts are used. The frame and front axle assembly is special; the cross elliptic front spring was abandoned in favor of special semi-elliptics. The steering system has been changed to the worm type and special steering knuckles and fittings were deemed necessary. It is said that the special frame will be strengthened throughout with regular Ford make cross members. Special alloy aluminum pistons of a new make are employed. The battery ignition system, which is special, is of unusually light weight construction, weighing complete only four pounds.

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Since the Bordino-driven Fiat showed its class and speed last Sunday at Los Angeles it has been ranked a first line contender. An article written by Jimmy Murphy on the subject of speedway racing stated, among other things, that the new Fiat engines are about the finest examples of engine construction that have ever been seen in America. He also stated that the chassis construction was not exactly suited for speedway racing, but prophesied that if the Fiat started at Indianapolis it could be counted on to put out enough stuff to be a possible winner.

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Wallace Reid, the moving picture star, will not drive the Duesenberg straight eight at Indianapolis. His hopes and plans for fame on the banked tracks have been shattered because the film company which has him under contract has refused to allow him to compete. The car assigned to him, however, will be given to some driver on the Duesenberg waiting list.

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There have been nine 500-mile races on the Hoosier track and four of the nine winning drivers will compete this year. No driver has even won two first places in the classic. Three of the former winners not entered have retired from the sport, one is dead, and the other, Rene Thomas, was unable to secure a suitable car for this year. The four men entered who have each tasted once the fruits of victory are: Jules Goux, Tommy Milton, Ralph De Palma and Howard Wilcox. It is interesting to note that one of these men has remained loyal to the car that made possible his first Indianapolis victory. The man and the car are Wilcox and Peugot.

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De Palma, whose first love was a Mercedes and who later became infatuated with the petit Ballot has had a change of heart again and will husband an American-made Duesenberg. De Palma has high ideals which he hopes to materialize later with a car of his own design.

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Tommy Milton, who gathered the golden harvest last year with one of Louis Chevrolet's Frontenacs, has a feeling he will cop the dough with one of this year's crop of Millers.

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Goux, who won the Speedway first prize in 1913, and an American wife later, has not become denationalized, but the car make listed after the driver's name will be changed from Peugot to Ballot on the 1922 scoreboard. No one at this time knows who will drive the sister Ballot, but it will be announced soon, because Goux and his wife have already arrived at Indianapolis, the home town of Mme. Goux.

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### TO RADIO RACE RESULTS

Indianapolis, May 15—Progress of the 500 mile Indianapolis Sweepstakes on May 30, will be broadcasted every half hour. It is said that the starting bombs and the massed band of 1000 pieces that will parade just before the start of the race will also be heard by the listeners-in who cannot attend the big event. It is expected that distant dealers who have their sales rooms equipped with receiving sets can entertain the race fans who will watch the race by the radio route this year.

Few of the outside contenders in the race have yet reached the Speedway with their mounts. Goux was the first foreigner to arrive, reaching Indianapolis May 10.

### NEW HAYNES TYPES

Kokomo, Ind., May 16—The Haynes Automobile Co. is fitting the model 75 chassis with two bodies which are new to this chassis, these being the 5-passenger brougham and the 2-passenger Blue Ribbon Speedster. These body types were previously fitted to the model 47 chassis. The driver's seat in the brougham is upholstered in leather and the side tire carriers are mounted at the front end of the three-quarter length runningboard on each side. The speedster has individual steps and individual fenders and the two extra wheels are mounted on each side of the cowl.

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### SHOW AT CENTRAL CITY, NEB.

Central City, Neb., May 13—Under the direction of the Business Men's Club, an automobile show will be given here from May 24 to 27.

# Specifications of Current Motor Truck Models

| NAME AND MODEL | Tons Capacity | Chassis Price | Bore and Stroke | TIRES Front | TIRES Rear | Final Drive |
|---|---|---|---|---|---|---|
| Acason | ¾-1 | $1650§ | 3¾x5 | 34x5† | 34x5† | W |
| Acason | 1½ | 1950 | 3¾x5½ | 36x3½ | 36x6 | W |
| Acason | 2½ | 2750 | 4⅜x5¼ | 36x4* | 36x8* | W |
| Acason | 3½ | 3450 | 4⅜x5¾ | 36x5* | 36x10* | W |
| Acason | 5 | 4350 | 5 x6¼ | 36x6 | 40x12 | W |
| Ace | 1½ | 2295 | 3¾x5⅛ | 34x3½* | 34x5* | W |
| Ace | 2½ | 2795 | 4¼x5½ | 36x4* | 36x7 | W |
| Acme | 1 | .... | 3¾x5 | 35x5† | 35x5† | W |
| Acme | 1½ | .... | 3¾x5 | 34x3½ | 34x5 | W |
| Acme | 1½ | .... | 3¾x5 | 34x3½ | 34x5 | W |
| Acme | 3 | .... | 4⅛x5¼ | 36x4 | 36x7 | W |
| Acme | 3 | .... | 4½x5½ | 36x4 | 36x7* | W |
| Acme | 4½ | .... | 4½x5½ | 36x5 | 40x10 | W |
| Acme | 6½ | .... | 4¾x6 | 36x6 | 40x12 | W |
| American | 2½ | 3350 | 4 x6 | 36x4* | 36x4d* | W |
| American | 4 | 4275 | 4½x6 | 36x5* | 36x5d* | W |
| Apex | 1 | 1450‖ | 3½x5 | 33x5† | 33x5† | I |
| Apex | 1½ | 1915 | 3¾x5½ | 34x3½ | 31x4 | I |
| Apex | 2½ | 2695 | 4¼x5½ | 36x4 | 36x7 | I |
| Apex | 3½ | 3975 | 4½x6 | 36x5 | 36x10 | I |
| Armleder | 1 | 2350 | 3¾x5¼ | 34x3½* | 34x5* | W |
| Armleder | 1½ | 2425 | 3⅝x5¼ | 34x3½ | 34x6 | W |
| Armleder | 1½ | 2850 | 4¼x5¼ | 34x3½ | 36x6 | W |
| Armleder | 2½ | 3200 | 4¼x5½ | 36x4* | 36x7* | W |
| Armleder | 3½ | 4150 | 4½x6 | 36x5 | 36x5d | W |
| Atco | 1½ | .... | 3¾x5¼ | 34x5† | 36x6† | W |
| Atco | 1½ | .... | 3¾x5¼ | 34x5† | 36x6† | I |
| Atco | 2½ | .... | 4¼x5½ | 36x4† | 36x8* | W |
| Atlas | MD | 1 | 1185 | 3½x5 | 32x4½† | 32x4½† | W |
| Atterbury | 20R | 1½ | 2475 | 3¾x5 | 34x3½ | 34x5 | W |
| Atterbury | 7CX | 2½ | 3175 | 4½x5¼ | 36x4 | 36x4d | W |
| Atterbury | 7D | 3½ | 3975 | 4½x5½ | 36x5 | 40x5d | W |
| Atterbury | 8E | 5 | 4975 | 4¾x6 | 36x5 | 40x6d | W |
| Autocar | 21UF | 1½-2 | 1950 | 4¾x4½ | 34x4* | 34x5* | D |
| Autocar | 21UG | 1½-2 | 2050 | 4¾x4½ | 34x4* | 34x5* | D |
| Autocar | 27H | 2 | 2950 | 4 x5½ | 34x5 | 36x7 | D |
| Autocar | 27K2 | 2 | 3075 | 4 x5½ | 34x5 | 36x7* | D |
| Autocar | 26Y | 5 | 3350 | 4¼x5½ | 34x6 | 36x12 | D |
| Autocar | 26-B | 5 | 4100 | 4¼x5½ | 34x6 | 36x12 | D |
| Available | H1½ | 1½ | 2175 | 4 x5 | 36x3½* | 36x5* | W |
| Available | H2 | 2 | 2775 | 4 x5 | 36x3½* | 36x6* | W |
| Available | H2½ | 2½ | 3160 | 4 x5 | 36x4* | 36x8* | W |
| Available | H3½ | 3½ | 4175 | 4½x5½ | 36x5 | 40x5d | W |
| Availabl | H5 | 5 | 5375 | 5 x6 | 36x6 | 40x12 | W |
| Avery | I | .... | 3 x4 | 34x5† | 34x5† | I |
| Beck | A Jr. | 1 | 1850 | 3½x5 | 32x4½ | 33x5 | I |
| Beck | B-30 | 1½ | 2050 | 3¾x5 | 34x5 | 36x6 | |
| Beck | C-40 | 2 | 2150 | 3¾x5 | 36x6 | 36x6 | |
| Beck | D-50 | 2½ | 2850 | 4¼x5¼ | 38x7 | 40x8 | |
| Bell | (Pen .) | ½ | 1300 | 3½x5 | 31x4§ | 31x4 | B |
| Bell | M (Iowa) | 1 | 1495 | 3⅝x5⅛ | 35x5 | 35x5† | W |
| Bell | E (Iowa) | 1½ | 2100 | 3¾x5¼ | 34x3½ | 34x5 | I |
| Bell | O (Iowa) | 2½ | 2550 | 4½x5½ | 34x4 | 34x6 | I |
| Belmont | A | ½ | 725 | 3¾x4¼ | 31x4 | 31x4 | B |
| Belmont | D | 2 | 2575 | 4¼x5½ | 34x3½* | 34x6* | I |
| Belmont | F | 3 | 3500 | 4 x6 | 36x5* | 36x5d* | I |
| Bessemer | G | 1 | .... | 3½x5 | 35x5† | 35x5† | I |
| Bessemer | H-2 | 1½ | .... | 3¾x5 | 36x3½ | 36x5 | I |
| Bessemer | J-2 | 2½ | .... | 4½x5¼ | 36x4 | 36x4d | I |
| Bessemer | K-2 | 4 | .... | 4½x5½ | 36x5 | 36x10 | I |
| Big 4 | H | 1½-4 | 5000 | 4½x6 | 36x6 | 36x6 | W |
| Big 4 | T | 4 | 5500 | 4¾x6 | 36x6 | 36x6 | W |
| Big 4 | K | 7 | 6000 | 5½x6 | 36x6 | 36x6 | W |
| Big 4 | HA | 7 | 6000 | 4½x6 | 36x6 | 36x10 | W |
| Brinton | C | 1½ | 1500 | 3¾x5 | 34x4 | 34x5 | W |
| Brinton | D | 2½ | 2250 | 4⅝x5¼ | 36x4 | 36x7 | W |
| Brockway | E | 1 | .... | 3¾x5⅛ | 35x5† | 35x5† | B |
| Brockway | S-5 | 1½ | .... | 3¾x5 | 36x3½* | 36x5* | W |
| Brockway | SK | 1½ | .... | 4½x5¼ | 36x4 | 36x6 | |
| Brockway | KR | 2½ | .... | 4½x5½ | 36x4 | 36x8 | |
| Brockway | K-5 | 2½ | .... | 4½x5¼ | 36x4 | 36x8 | W |
| Brockway | RT | 3½ | .... | 4¾x6 | 36x5 | 36x10 | |
| Brockway | R-4 | 3½ | .... | 4½x5½ | 36x5 | 36x5d | W |
| Brockway | T-4 | 5 | .... | 4¾x6 | 36x6 | 40x6d | W |
| Buick | Delivery | | 945†† | 3⅝x4¾ | 31x4† | 31x4† | B |
| Capitol | G1½ | 1½ | 2975 | 3¾x5 | 35x5 | 38x7 | W |
| Capitol | H2½ | 2½ | 3700 | 4¼x6 | 36x4 | 36x8 | W |
| Capitol | K2½ | 2½ | 4250 | 4¼x6 | 36x6 | 42x9 | W |
| Capitol | M3½ | 3½ | 4425 | 4¼x6 | 36x5 | 36x10 | W |
| Case | | 2 | .... | 4¼x5¾ | 36x6 | 38x7 | I |
| Champion Light Commercial | | ½ | 1050†† | 3½x5 | 32x3½ | 32x3½ | I |
| Chevrolet | G | ¾ | 745 | 3½x4 | 31x4† | 34x4½† | B |
| Chevrolet | T | 1 | 1125 | 3½x5¼ | 33x4† | 35x5† | W |
| Chicago | C1½ | 1½ | .... | 3¾x5⅛ | 36x3½* | 36x5* | W |
| Chicago | C2½ | 2½ | .... | 4 x5⅛ | 36x4* | 36x7* | W |
| Chicago | C3½ | 3½ | .... | 4½x5½ | 36x5 | 36x10 | W |
| Chicago | D5 | 5 | .... | 4½x5½ | 36x6 | 40x12 | W |
| Climber | A-20 | 1½ | 2050 | 3½x5 | 36x6* | 38x7* | I |
| Clydesdale | 10 | ¾-1½ | 1485 | 3¾x5 | 34x5 | 34x5 | B |
| Clydesdale | 18 | ¾-1½ | 1890 | 3¾x5 | 34x5 | 34x5 | W |
| Clydesdale | 20 | 1-1½ | 2385 | 3¾x5 | 34x5 | 34x5* | W |
| Clydesdale | 42 | 1½-2 | 2175 | 3¾x5 | 36x3½ | 36x6 | W |
| Clydesdale | 65X | 2½-3 | 3250 | 4½x5¼ | 36x4 | 36x8 | W |
| Clydesdale | 65EX | 2½-3 | 3150 | 4½x5½ | 36x4 | 36x8 | W |
| Clydesdale | 90 | 3½-4½ | 4100 | 4½x5½ | 36x5 | 36x10 | W |
| Clydesdale | 120 | 5-6 | 4500 | 4¾x6 | 36x6 | 40x12 | W |
| Columbia | H | 1½ | 1895 | 4 x5 | 35x5 | 38x7† | I |
| Columbia | G | 2½ | 2335 | 4 x5¼ | 36x4 | 36x7 | I |
| Comet | T | 1½ | 1950 | 3¾x5 | 34x4 | 34x4 | W |
| Commerce | T | ¾-1½ | 1450 | 3¾x5 | 34x4½† | 34x4½† | B |
| Commerce | 12 | 1½ | 1800 | 3¾x5 | 35x5† | 35x5† | I |
| Commerce | 16 | 2 | 2150 | 3¾x5 | 35x5† | 36x6 | I |
| Commerce | 18 | 2½ | 2495 | 4½x5¼ | 36x6† | 36x7† | I |
| Commerce | 25 | 2½ | 2425 | 4½x5¼ | 36x4 | 36x7 | W |
| Concord | A | 2 | $3150 | 4 x5½ | 36x3½ | 36x6 | W |
| Concord | B | 3 | 3600 | 4¼x5½ | 36x4 | 36x8 | W |
| Concord | AX | 2 | 3250 | 4 x5½ | 36x3½ | 36x6 | W |
| Concord | BX | 3 | 3600 | 4½x5½ | 36x4 | 36x8 | W |
| Cook | 51 | 2½ | 3600 | 4 x5⅜ | 36x6† | 40x8† | W |
| Corbitt | E-22 | 1 | 1480 | 3¾x5 | 34x3½ | 34x4 | W |
| Corbitt | D-22 | 1½ | 2200 | 3¾x5 | 34x3½ | 34x4 | W |
| Corbitt | C-22 | 2 | 2600 | 4¼x5¼ | 36x3½ | 36x6 | W |
| Corbitt | B-22 | 2½ | 3000 | 4½x5¼ | 36x4 | 36x7 | W |
| Corbitt | R-22 | 3 | 3200 | 4½x5½ | 36x4 | 36x8 | W |
| Corbitt | A-22 | 3½-4 | 3800 | 4½x5½ | 36x5 | 36x10 | W |
| Corbitt | AA-22 | 5 | 4500 | 4¾x6 | 36x6 | 40x6d | W |
| Day-Elder | AS | 1 | 1600 | 3¾x5 | 35x5† | 35x5† | W |
| Day-Elder | B | 1½ | 2000 | 3¾x5 | 34x3½ | 34x5 | W |
| Day-Elder | D | 2 | 2400 | 4½x5¼ | 36x4 | 36x7 | W |
| Day-Elder | C | 2½ | 2750 | 4¼x5½ | 36x4 | 36x7 | W |
| Day-Elder | F | 3½ | 3150 | 4½x5½ | 36x5 | 36x5d | W |
| Day-Elder | E | 5 | 4250 | 4½x6 | 36x5* | 40x6d* | W |
| Dearborn | E | 1 | 1600 | 3⅝x5½ | 35x5† | 35x5† | W |
| Dearborn | FX | 1½ | 2300 | 3⅝x5⅛ | 34x4 | 34x5 | W |
| Dearborn | F | 1½ | 2180 | 3⅝x5⅛ | 34x4 | 34x5 | W |
| Dearborn | 48 | 2 | 2590 | 3⅝x5⅛ | 34x4½† | 34x7 | W |
| Defiance | G | 1 | 1695§ | 3¾x5 | 35x5† | 35x5† | B |
| Defiance | D | 1½ | 2095§ | 3¾x5 | 35x5† | 36x6† | I |
| Defiance | E | 2 | 2275§ | 3¾x5 | 35x5† | 38x7† | I |
| DeMartini | 1½ | 1½ | 2600 | 3¾x5 | 34x3½ | 34x6 | W |
| DeMartini | 2 | 2 | 3300 | 4 x5½ | 36x3½ | 36x7 | W |
| DeMartini | 3 | 3 | 4250 | 4¼x5½ | 36x4 | 36x10 | W |
| DeMartini | 4 | 4 | 4800 | 4½x6 | 36x5 | 36x12 | W |
| Denby | 31 | 1½ | 1485 | 3½x5 | 35x5† | 35x5† | B |
| Denby | 33 | 1½ | 2145 | 3¾x5 | 35x5† | 38x7† | I |
| Denby | 34 | 2 | 2395 | 3¾x5 | 36x3½ | 36x6 | I |
| Denby | 35 | 2½-3 | 2795 | 4½x5¼ | 36x4 | 36x7 | I |
| Denby | 27 | 4 | 3895 | 4½x5½ | 36x5 | 36x5d | I |
| Denby | 210 | 5 | 4295 | 4½x5½ | 36x6 | 40x6d | I |
| Dependable | A | ¾-1 | 1650 | 3⅝x5⅛ | 34x5† | 36x6† | W |
| Dependable | C | 2 | 2350 | 3¾x5¼ | 34x3½ | 34x5 | W |
| Dependable | D | 2½ | 2650 | 4 x5½ | 34x5 | 36x6 | W |
| Dependable | E | 3 | 2950 | 4¼x5½ | 36x4 | 36x7 | W |
| Diamond T | O-8 | 1-1¼ | 1975 | 3¾x5¼ | 36x3½† | 36x4† | W |
| Diamond T | T | 1½ | 2250 | 3¾x5¼ | 36x3½ | 36x5 | W |
| Diamond T | U | 2-2½ | 2650 | 4 x5¼ | 36x4 | 36x7 | W |
| Diamond T | K | 3½ | 3750 | 4¼x5½ | 36x5 | 36x5d | W |
| Diamond T | EL | 5 | 4325 | 4½x5½ | 36x6 | 40x6d | W |
| Diamond T | S | 5 | 4500 | 4¾x6 | 36x6 | 40x6d | W |
| Diehl | A | 1 | .... | 3½x5 | 34x4½ | 35x5 | I |
| Diehl | B | 1½ | .... | 3½x5 | 36x6 | 36x6 | I |
| Dispatch | F | 1 | 1350 | 3¾x5 | 34x4† | 34x4† | I |
| Doane | | 2½ | 4100‖ | 4¼x5¾ | 36x5 | 36x7 | C |
| Doane | | 3½ | 5100‖ | 4⅜x5¾ | 36x5 | 36x5d | C |
| Doane | | 6 | 6000‖ | 5 x6¼ | 36x6 | 40x6d | C |
| Dodge Brothers | | ½ | 730 | 3⅞x4½ | 32x4† | 32x4† | B |
| Dorris | K-4 | 2-2½ | 3400 | 4¼x5½ | 36x4 | 36x7 | W |
| Dorris | K-7 | 3½ | 4400 | 4¼x5½ | 36x5 | 36x10 | W |
| Dort | 103 | ½ | 685 | 3½x5 | 31x4 | 31x4 | B |
| Double Drive | B | 3 | 4000 | 4¼x5½ | 6 | 6 | W |
| Duplex | A | 2 | 2775 | 4 x5¼ | 35x5† | 38x7† | W |
| Duplex | E | 3½ | 3500 | 4¼x5½ | 36x8 | 36x8 | I |
| Duty | 22 | 2 | 1500 | 3½x5 | 34x3½ | 34x5 | I |
| Eagle | 101 | 1½ | 1875 | 3⅝x5½ | 34x5 | 34x5 | I |
| Eagle | 100-2 | 2 | 2275 | 3¾x5¼ | 34x4* | 34x7* | I |
| Erie | E | 1½ | 2185 | 3¾x5¼ | 36x6† | 36x6† | W |
| Erie | A | 2½ | 2985 | 4¼x5½ | 36x4 | 36x4d | W |
| F. W. D. | B | 3 | 4200 | 4¾x5½ | 36x6 | 36x6 | B |
| Facto | 1921 | 2½ | 2295¶ | 4¼x5½ | 36x4* | 36x8* | W |
| Fageol | 1½ | 1½ | 3000 | 3¾x5¼ | 34x3½* | 34x6* | W |
| Fageol | 2½ | 2½ | 3900 | 4¼x5¾ | 34x4 | 36x7 | W |
| Fageol | 3½ | 3½ | 5000 | 4½x6¼ | 36x5* | 40x5d* | W |
| Fageol | 5 | 5 | 5700 | 4½x6¼ | 36x6 | 40x6d | W |
| Fargo | R | 2 | 1900 | 3¾x | 36x4 | 36x6 | I |
| Federal | SD | 1½ | 1800 | 3¾x5 | 35x5† | 36x6† | W |
| Federal | TE | 1½ | 2175 | 4¼x5¼ | 36x3½ | 36x5 | W |
| Federal | UE | 2-2½ | 2425 | 4¼x5¼ | 36x4 | 36x7 | W |
| Federal | WE | 3½-4 | 3150 | 4½x5½ | 36x5 | 36x5d | W |
| Federal | X2 | 5-6 | 4500 | 4¾x6 | 36x6 | 40x6d | W |
| Ford | TT | 1 | 430 | 3¾x4 | 30x3½† | 32x4½† | W |
| Forschler | A | 1 | .... | 3½x5 | 34x3 | 34x4 | W |
| Forschler | AX | 1½ | .... | 3½x5 | 36x3½ | 36x5 | W |
| Forschler | B | 2 | .... | 4½x5¼ | 36x4 | 36x7 | W |
| Forschler | BX | 3 | .... | 4½x5¼ | 36x4 | 36x8 | W |
| Front Drive | C | 1½ | 2800 | 3¾x5½ | 5 | 4 | W |
| G & J** | 20 | 1 | 2275 | 3⅝x5½ | 34x5† | 34x5† | W |
| G & J** | A | 2-2½ | 3375 | 4x5¼ | 36x4 | 36x7 | W |
| G & J** | B | 3½-4 | 4475 | 4½x5½ | 36x5 | 36x10 | W |
| G.M.C. | K16 | 1 | 1295 | 3½x5½ | 34x5† | 34x5† | B |
| G.M.C. | K-41A | 2 | 2375 | 4 x5½ | 36x4* | 36x7* | W |
| G.M.C. | K-41B | 2 | 2375 | 4 x5½ | 36x4* | 36x7* | W |
| G.M.C. | K-71A | 3½ | 3600 | 4½x6 | 36x5 | 40x5d | W |
| G.M.C. | K-71B | 3½ | 4050 | 4½x6 | 36x5 | 40x5d | W |
| G.M.C. | K-101A | 5 | 3950 | 4½x6 | 36x5 | 40x6d | W |
| G.M.C. | K-101B | 5 | 4450 | 4½x6 | 36x5 | 40x5d | W |
| G.W.W. | | 1½ | 1850 | 3¾x5½ | 35x5 | 35x5 | I |
| Garford | 15 | ¾ | 1590 | 3⅝x5⅛ | 34x5† | 34x5† | W |
| Garford | 25-B | 1 1/4 | 1990 | 3¾x5½ | 36x6† | 36x6† | W |
| Garford | 70-H | 2 | 2750 | 4¼x5½ | 36x4 | 36x7 | W |
| Garford | 77-D | 3½ | $3750 | 4½x6 | 36x5 | 36x6d | W |
| Garford | 68D | 5 | 4500 | 5 x6½ | 36x6 | 40x6d | W |
| Garford | 150-A | 7½ | 5200 | 5½x6 | 36x6 | 40x7d | C |
| Gary | F | 1-1½ | 1675 | 3¾x5 | 36x3½ | 36x4 | W |
| Gary | I | 2 | 2150 | 4 x5½ | 36x3½ | 36x6 | W |
| Gary | J | 2½ | 2550 | 4¼x5½ | 36x4 | 36x8 | W |
| Gary | K—† | 3½ | 3550 | 4½x6 | 36x5 | 40x5d | W |
| Gary | M | 5 | 4000 | 5 x6½ | 36x6 | 40x6d | W |
| Gersix | M | 1½ | 3100 | 4 x5½ | 36x3½ | 36x7 | W |
| Gersix | K | 2½ | 3500 | 4½x5½ | 36x4 | 36x8 | W |
| Gersix | | 3½ | 4500 | 4½x6 | 36x5 | 40x12 | W |
| Golden West | GH | 3 | 4500 | 4½x6 | 36x7 | 36x7 | W |
| Golden West | G | 3½ | 5090 | 4½x5½ | 36x6 | 36x6 | W |
| Graham Bros. | 1-Ton | 1 | 1265 | 3⅞x4½ | 33x4½† | 34x5† | B |
| Graham Bros. | 1½-Ton | 1½ | 1325 | 3⅞x4½ | 33x4½† | 36x6† | B |
| 1Gramm-Pion. | 10 | 1 | 1365 | 3½x5 | 33x5† | 33x5† | F |
| 1Gramm-Pion. | 15 | 1½ | 1900§ | 3¾x5 | 36x3½* | 36x5* | I |
| 1Gramm-Pion. | 65 | 1½ | 2500§ | 3¾x5 | 36x3½* | 36x5 | W |
| 1Gramm-Pion. | 20 | 2 | 2925§ | 4¼x5½ | 36x4* | 36x7* | W |
| 1Gramm-Pion. | 30 | 3 | 3275§ | 4¼x5½ | 36x4* | 36x4d* | W |
| 1Gramm-Pion. | 75P | 3½ | 4225§ | 4½x5½ | 36x6† | 42x9† | W |
| 1Gramm-Pion. | 40 | 4 | 3995§ | 4½x5½ | 36x5 | 36x5d* | W |
| 1Gramm-Pion. | 50 | 5-6 | 4895§ | 4¾x6 | 36x6 | 40x6d* | W |
| Hahn | B2 | 1 | 1700§ | 3¾x5 | 34x5* | 34x5* | W |
| Hahn | O | 1½ | 1900 | 4¼x5¼ | 36x3½* | 36x6* | W |
| Hahn | K | 2 | 2225 | 4½x5½ | 36x4* | 36x8* | W |
| Hahn | M | 5 | 3500 | 4¾x6 | 36x6 | 40x12 | W |
| Hahn | N | 6 | 4500 | 4¾x6 | 36x6 | 40x12 | W |
| Hal-Fur | E | 1½ | 2350 | 4 x5¼ | 34x5† | 38x7† | W |
| Hal-Fur | B | 2½ | 3000 | 4¼x5½ | 36x6† | 36x8 | W |
| Hal-Fur | F | 3½ | 4000 | 4½x5½ | 36x6† | 40x10 | W |
| Hall | 1½ | 1½ | 3100 | 3¾x5 | 34x5† | 38x7† | W |
| Hall | 2½ | 2½ | 3275 | 4¼x5¼ | 36x4 | 36x6 | W |
| Hall | 3½ | 3½ | 4100 | 4½x5½ | 36x5 | 36x5d | W |
| Hall | 5 | 5 | 5100 | 4½x5½ | 36x5 | 40x6d | W |
| Hall | 7 chain | 7 | 5100 | 4½x5½ | 36x5 | 40x6d | C |
| Harvey | WOA | 2 | 2650 | 4¼x5½ | 34x4 | 34x7 | W |
| Harvey | WFA | 2½ | 2950 | 4¼x5½ | 36x4 | 36x7 | W |
| Harvey | WHA | 3½ | 3050 | 4½x6 | 36x5 | 36x5d | W |
| Hawkeye | K | 1½ | 1850 | 3¾x5½ | 34x3½* | 34x5* | I |
| Hawkeye | M | 2 | 2650 | 4¼x5 | 36x4* | 36x6* | I |
| Hawkeye | N | 3½ | 3700 | 4½x6¾ | 36x5* | 36x10* | I |
| Hendrickson | O | 1½ | 2200 | 3⅝x5⅛ | 36x4† | 36x5† | W |
| Hendrickson | N | 2½ | 2690 | 4¼x5¾ | 36x4* | 36x7* | W |
| Hendrickson | M | 3½ | 3000 | 4¼x5 | 36x5* | 36x5d* | W |
| Hendrickson | K | 5 | 4000 | 5 x6¾ | 36x6 | 40x6 | W |
| Huffman | B | 1½ | 1995 | 3¾x5 | 34x3½ | 34x6 | W |
| Huffman | C | 1½ | 1795 | 3¾x5½ | 34x3½ | 34x6 | I |
| Hurlburt | A | 1½ | 2850 | 4 x5½ | 34x4 | 34x5 | W |
| Hurlburt | B | 2½ | 3750 | 4¼x5½ | 36x4 | 36x4d | W |
| Hurlburt | C | 3½ | 4590 | 4½x6 | 36x5 | 36x5d | W |
| Hurlburt | D | 5 | 5500 | 4½x6 | 36x5 | 40x6d | W |
| Indep'd't(Iowa) | B | 1 | 1665 | 3½x5 | 34x3½ | 34x4 | I |
| Indep'd't(Iowa) | G | 1½ | 2040 | 3¾x5¼ | 34x3½ | 34x5 | I |
| Indep'd't(Ia.) | H1 | 2½ | 2940 | 4½x5¼ | 36x4 | 36x4 | I |
| Indep'd't(Ohio) | F | 1½ | 2385 | 3¾x5 | 36x3½ | 36x5 | W |
| Indep'd't(Ohio) | H | 2½ | 3085 | 4½x5¼ | 36x4 | 36x4d | W |
| Indep'd't(Ohio) | K | 3½ | 3985 | 4½x5½ | 36x5 | 36x5d | W |
| Indiana | 12 | 1½ | .... | 3¾x5¼ | 34x3½* | 34x5* | W |
| Indiana | 20 | 2 | .... | 4½x5½ | 36x4* | 36x7* | W |
| Indiana | 25 | 2½ | .... | 4½x5½ | 36x4* | 36x8* | W |
| Indiana | 35 | 3½ | .... | 4⅝x5½ | 36x5* | 36x5d* | W |
| Indiana | 51 | 5 | .... | 5 x6¼ | 36x5* | 40x6d* | W |
| Inland | D | 2 | 2950 | 4 x5 | 34x5 | 34x6 | I |
| International | S | ¾ | 1500 | 3½x5 | 34x5† | 34x5† | I |
| International | 21 | 1 | 1750 | 3½x5¼ | 36x3½ | 36x3½ | I |
| International | 31 | 1½ | 1850 | 3½x5¼ | 36x3½ | 36x4 | I |
| International | 41 | 2 | 2100 | 3½x5¼ | 36x3½ | 36x5 | I |
| International | 61 | 3 | 2400 | 4¼x5 | 36x4 | 36x6 | I |
| International | 101 | 5 | 3600 | 4¼x5 | 36x5 | 40x10 | I |
| J & J | D | 2 | 3250 | 4 x5 | 34x4* | 34x6 | I |
| Jackson | 4WD | 3½ | 3850 | 4½x5½ | 36x7 | 36x7 | B |
| Jumbo | 15 | 1½ | 2295 | 3¾x5¼ | 36x3½ | 36x5 | I |
| Jumbo | 20 | 2 | 2520 | 3¾x5¼ | 35x5† | 38x7† | I |
| Jumbo | 25 | 2½ | 2660 | 4½x5½ | 36x4 | 36x7 | I |
| Jumbo | 30 | 3 | 3060 | 4¼x5½ | 36x6† | 42x9† | I |
| Jumbo | 35 | 3½ | 3900 | 4½x6 | 36x5 | 36x10† | I |
| Jumbo | 40 | 4 | 4400 | 4½x6 | 38x7† | 44x10 | I |
| K-Z | 1 | 1 | 1750 | 3½x5 | 34x3½ | 34x5 | W |
| K-Z | 1½ | 1½ | 2075 | 3¾x5 | 36x4 | 36x6 | W |
| K-Z | 2½ | 2½ | 2550 | 4½x5¼ | 36x4 | 36x8 | W |
| K-Z | 3½ | 3½ | 3350 | 4½x5½ | 36x5 | 40x10 | W |
| K-Z | 5 | 5 | 3850 | 4½x5½ | 36x6 | 40x6d | W |
| Kalamazoo | G-1 | 1½ | 2495 | 3¾x5 | 34x4 | 34x5 | W |
| Kalamazoo | G-2 | 1½ | 2800§ | 3¾x5 | 36x4 | 36x6 | W |
| Kalamazoo | H | 2½ | 3275§ | 4 x5 | 36x4 | 36x8 | W |
| Kalamazoo | K | 3½ | 4000§ | 4¼x6 | 36x5 | 36x10 | W |
| Kalamazoo | K-5 | 5 | 4500§ | 4½x6 | 36x6 | 40x6d | W |
| Karavan | A | 2½ | 3750 | 4¼x6 | 36x4 | 36x8 | I |
| Kearns | H | 1 | 1150 | 3½x5 | 32x4½† | 32x4½† | I |
| Kearns | N | 2 | 1650 | 3½x5 | 34x3½ | 34x6 | I |
| 2Kelly-S. | K-31 | 1½ | 2700 | 3¾x5¼ | 36x3½ | 36x6 | C |
| 2Kelly-S. | K-34 | 1½ | 2700 | 3¾x5¼ | 36x3½ | 36x6 | W |
| 2Kelly-S. | K-38 | 2½ | 2900 | 3¾x5¼ | 36x4 | 36x4d | W |
| 2Kelly-S. | K-35 | 2½ | 2900 | 3¾x5¼ | 36x4 | 36x4d | C |
| 2Kelly-S. | K-40 | 3½ | 3900 | 4½x6½ | 36x5 | 40x5d | C |
| 2Kelly-S. | K-41 | 3½ | 3900 | 4½x6½ | 36x5 | 36x10 | I |
| 2Kelly-S. | K-42 | 3½ | 3900 | 4½x6½ | 36x5 | 40x5d | W |
| 2Kelly-S. | K-50 | 5 | 4400 | 4½x6½ | 36x6 | 40x6d | C |
| 2Kelly-S. | K-60 | 6 | 4500 | 4½x6½ | 36x6 | 40x7d | I |
| Keystone | 40 | 2 | 2175 | 3¾x5½ | 34x5† | 38x7† | W |
| Kimball | AB | 2 | 3675 | 4 x6 | 36x4 | 36x7 | W |

*2-cyl. †6-cyl. ‡8-cyl. All others, not marked, are 4-cyl. Trac., Tractor. **Canadian made.

**Final Drive:** W—Worm, I—Internal Gear, C—Chains, D—Double Reduction. B—Bevel, 4—Four-Wheel, E—External Gear. *Tires—optional. †Pneumatic Tires. d—dual. All others solid. ††Price includes body. §—Price includes several items of equipment.

1—Gramm-Pioneer. 2—Kelly-Springfield.

# Specifications of Current Motor Truck Models—Continued

| NAME AND MODEL | Tons Capacity | Chassis Price | Bore and Stroke | TIRES Front | TIRES Rear | Final Drive |
|---|---|---|---|---|---|---|
| Kimball.....AC | 2½ | $3975 | 4¼x6 | 36x4 | 36x8 | W |
| Kimball.....AK | 3 | 4500 | 4¼x6 | 36x4 | 36x10 | W |
| Kimball.....AE | 4 | 5000 | 4¾x6 | 36x5 | 40x12 | W |
| Kimball.....AF | 5 | 5500 | 5 x6 | 36x6 | 40x7d | W |
| Kissel....Express | 1 | 1585† | 3¾x5½ | 34x5† | 34x5† | W |
| Kissel.....Utility | 1½ | 1975 | 3¾x5½ | 36x3½ | 36x5 | W |
| Kissel...Freighter | 2½ | 2875 | 4¼x5½ | 36x4 | 36x7 | W |
| Kissel.....H. D. | 4 | 3675 | 4¼x5½ | 36x5 | 36x5d | W |
| Kleiber.....AA | 1 | 2200 | 4¼x5¼ | 34x3½* | 34x5* | W |
| Kleiber.....A | 1½ | 3100 | 4¼x5¼ | 36x3½* | 36x6* | W |
| Kleiber.....BB | 2 | 3600 | 4¼x5¼ | 36x4* | 36x7* | W |
| Kleiber.....B | 2½ | 3950 | 4¼x5½ | 36x5* | 36x8 | W |
| Kleiber.....C | 3½ | 4600 | 4¼x5½ | 36x5 | 36x5d | W |
| Kleiber.....D | 5 | 5300 | 5 x6½ | 36x6 | 40x12 | W |
| Koehler.....D | 1½ | 1995 | 3½x5½ | 34x3½ | 34x5 | W |
| Koehler.....M | 2½ | 3175 | 4 x5¼ | 36x4 | 36x7 | W |
| Koehler.....MCS | 2½ | 3275 | 4 x5¼ | 36x4 | 36x7 | W |
| Koehler.....F | 3½ | 4150 | 4½x5½ | 36x5 | 36x10 | W |
| Koehler,MT. Trac | 5 | 3275 | 4 x5⅛ | 36x4 | 36x7 | W |
| Kreba-Collier..23 | ¾ | 1260 | 3¾x5 | 34x4½ | 34x4½ | B |
| Krebs-Collier..24 | 1 | 1565 | 3¾x5 | 34x5 | 34x5 | W |
| Krebs-Collier..45 | 1½ | 2125 | 4½x5½ | 36x4 | 36x7 | W |
| Krebs-Collier..75 | 2½ | 2375 | 4½x5½ | 36x4 | 36x8 | W |
| Krebs-Collier.110 | 3½ | 2975 | 4½x5½ | 36x5 | 40x10 | W |
| Lange.....B | 2½ | 3350 | 4½x5½ | 36x4* | 36x7* | C |
| Larrabee.....X-2 | 1 | 1925 | 3¼x4½ | 34x5† | 34x5† | B |
| Larrabee.....U | 1½ | 2400 | 3¾x5 | 34x3½ | 34x5 | W |
| Larrabee.....J | 1½–2½ | 2400 | 3¾x5 | 34x3½* | 34x5* | W |
| Larrabee.....K | 2½ | 3100 | 4½x5½ | 36x4 | 36x7 | W |
| Larrabee.....K-5 | 2½–3 | 3450 | 4½x5½ | 36x4 | 36x8 | W |
| Larrabee.....L-4 | 3½ | 4000 | 4½x5½ | 36x5 | 36x5d | W |
| Larrabee.....W | 5 | 4800 | 4¾x6 | 36x6 | 40x6d | W |
| Luedinghaus.....C | 1 | 1690 | 3½x5 | 35x5† | 35x5† | W |
| Luedinghaus...W | 1½ | 2490 | 3¾x5½ | 34x3½* | 34x5* | W |
| Luedinghaus...K | 2–2½ | 2790 | 4½x5¼ | 36x4* | 36x7* | W |
| Maccar.....L | 1½ | 2700 | 4½x5½ | 36x4 | 36x6 | W |
| Maccar...H-A | 2 | 3100 | 4½x5½ | 36x4 | 36x4d | W |
| Maccar...H-2 | 3 | 3400 | 4½x5½ | 36x4 | 36x5d | W |
| Maccar...H-3 | 4 | 4200 | 4½x5½ | 36x5 | 36x6d | W |
| Maccar.....G | 5–6 | 4950 | 4¾x6 | 36x5 | 40x6d | W |
| MacDonald...A | 7½ | 5750 | 4½x6 | 40x7 | 40x14 | I |
| Mack...AB D.R. | 1½ | 3150 | 4 x5 | 36x4 | 36x3½d | D |
| Mack...AB Chain | 1½ | 3000 | 4 x5 | 36x4 | 36x3½d | C |
| Mack...AB Chain | 2 | 3300 | 4 x5 | 36x4 | 36x4d | C |
| Mack....AB D.R. | 2 | 3750 | 4 x5 | 36x4 | 36x4d | D |
| Mack....AB D.R. | 2½ | 3850 | 4 x5 | 36x4 | 36x4d | D |
| Mack...AB Chain | 2½ | 3400 | 4 x5 | 36x4 | 36x4d | C |
| Mack...AC Chain | 3½ | 4950 | 5 x6 | 36x5 | 40x5d | C |
| Mack...AC Chain | 5 | 5500 | 5 x6 | 36x6 | 40x6d | C |
| Mack...AC Chain | 6½ | 5750 | 5 x6 | 36x6 | 40x12 | C |
| Mack...AC Chain | 7½ | 6000 | 5 x6 | 36x7 | 40x7d | C |
| Mack Trac....AB | 5 | 3400 | 4 x5 | 36x4 | 36x4d | C |
| Mack Trac....AC | 7 | 4950 | 5 x6 | 36x5 | 40x5d | C |
| Mack Trac....AC | 10 | 5500 | 5 x6 | 36x6 | 40x6d | C |
| Mack Trac....AC | 13 | 5750 | 5 x6 | 36x6 | 40x12 | C |
| Mack Trac....AC | 15 | 6000 | 5 x6 | 36x7 | 40x7d | C |
| Mapleleaf...AA** | 2 | 3775 | 4 x5¼ | 36x4 | 36x7 | W |
| Mapleleaf...BB** | 3 | 4350 | 4½x5½ | 36x4 | 36x4d | W |
| Mapleleaf...CC** | 4 | 5100 | 4½x5½ | 36x5 | 36x5d | W |
| Mapleleaf...DD** | 5 | 6200 | 4½x5½ | 36x6 | 40x6d | W |
| Master.....JW | 1½ | 2290 | 4½x5½ | 34x3½ | 34x5 | W |
| Master.....JD | 1½ | 2590 | 4½x5½ | 34x3½ | 34x5 | D |
| Master.....Z | 2 | 2290 | 4½x5½ | 34x3½ | 34x5 | W |
| Master.....W | 2½ | 2890 | 4½x5½ | 34x4 | 36x7 | W |
| Master.....DD | 2½ | 3190 | 4½x5½ | 34x4 | 36x7 | D |
| Master.....A | 3½ | 3990 | 4½x6 | 36x5 | 40x5d | W |
| Master.....E | 3½ | 4290 | 4½x6 | 36x5 | 40x5d | D |
| Master.....Y | 4 | 4490 | 4½x6 | 36x5 | 40x6d | D |
| Master.....B | 5 | 4990 | 4¾x6½ | 36x6 | 40x6d | W |
| Master.....F | 5 | 5090 | 4¾x6½ | 36x6 | 40x6d | D |
| MasterTrac.,DDT | 6 | 3390 | 4¼x5½ | 34x4 | 36x7 | D |
| Maxwell.....1½ | 1½ | 932 | 3½x4½ | 32x3 | 32x4 | W |
| Menominee...HT | 1–1¼ | 2000 | 3¾x5 | 34x3½ | 36x5 | W |
| Menominee...H | 1½ | 2475 | 4 x5 | 36x3½ | 36x5 | W |
| Menominee...D | 2–2½ | 2875 | 4 x6 | 36x4 | 36x8 | W |
| Menominee...G | 3½ | 3300 | 4½x6 | 36x5 | 36x10 | W |
| Menominee...J-3 | 5 | 4850 | 4¾x6 | 36x6 | 40x12 | W |
| Moline.....10 | 1½ | 1985 | 3½x5 | 34x5† | 36x6† | I |
| [3]Moreland..R. R. | 1 | 1595 | 4 x5 | 34x5† | 34x5† | B |
| Moreland.....BX | 1½ | 1980 | 4 x5 | 36x3½ | 36x6* | W |
| Moreland.....EX | 2 | 2800 | 4½x5½ | 36x4 | 36x7* | W |
| Moreland.....AX | 3 | 3500 | 4½x5½ | 36x5 | 36x10* | W |
| Moreland.....RX | 4½–5 | 4600 | 4¾x6 | 36x6 | 40x6 | W |
| Napoleon.....7 | ¾ | 1350 | 3½x5 | 38x4 | 33x4† | I |
| Napoleon.....9 | 1 | 1535 | 3½x5 | 35x5* | 35x5* | I |
| Napoleon.....11 | 1½ | 1860 | 3½x5 | 35x5* | 36x6* | I |
| Nash.....2018 | 1–1½ | 1595 | 3¾x5½ | 35x5 | 36x6 | I |
| Nash.....3018 | 2–2½ | 2150 | 3¾x5½ | 36x6 | 40x8 | I |
| Nash.....Quad. | 2–2½ | 2750 | 4¼x5½ | 40x8 | 40x8 | I |
| Nash. 3018, LWB | 2–2½ | 2200 | 3¾x5¾ | 36x6 | 40x8 | I |
| Nash. Quad. LWB | 2–2½ | 2800 | 4¼x5½ | 40x8 | 40x8 | I |
| Nash.....5018 | 2½ | 2250 | 3¾x5½ | 34x4 | 34x6 | I |
| [4]Nelson.....F1½ | 1½ | .... | 4½x5¼ | 36x3½ | 36x5 | W |
| [4]Nelson.....F2 | 2 | .... | 4½x5¼ | 36x4 | 36x7 | W |
| [4]Nelson.....F3½ | 3½ | .... | 4½x5½ | 36x5 | 36x5d | W |
| [4]Nelson.....FC5 | 5 | .... | 4¾x6 | 36x6 | 40x6d | W |
| Netco.....DK | 2 | 3100 | 4½x5¼ | 36x4* | 36x7* | W |
| Netco.....HL | 2½ | 3500 | 4½x5½ | 36x4* | 36x8* | W |
| New York.....M | 1½ | .... | 4½x5½ | 36x3½ | 36x5 | W |
| New York.....N | 2–2½ | .... | 4½x5¼ | 36x4 | 36x4d | W |
| Niles.....E | 2 | 3000 | 4½x5½ | 36x4* | 36x7* | W |
| Noble.....B30 | 1½ | .... | 3¾x5¼ | 36x3½ | 36x5 | W |
| Noble.....C40 | 2 | .... | 4 x5½ | 36x4 | 36x7 | W |
| Noble.....D50 | 2½ | .... | 4¼x5½ | 36x4 | 36x8 | W |
| Noble.....E70 | 3½ | .... | 4½x6 | 36x5 | 36x10 | W |
| Northway.....B-2 | 2 | 3400 | 4 x6 | 36x4 | 36x4d | W |
| Northway.....B-3 | 3½ | 4400 | 4 x6 | 36x5 | 40x5d | W |
| Northwestern..W | 1½ | 2700 | 4¼x5¼ | 34x4 | 36x6 | W |
| Northwestern..WS | 2½ | $3500 | 4¼x5½ | 36x4 | 36x8 | W |
| Norwalk.....25E | 1 | 1595 | 3¼x5 | 34x3½ | 34x4 | W |
| Norwalk.....35E | 1½ | 1925 | 3½x5 | 34x3½ | 34x3½d | W |
| Norwalk,35E.Spec | 1½ | 2285 | 3¾x5¼ | 34x3½ | 34x5 | W |
| O. K.....K1 | 1½ | 2450 | 4 x5½ | 36x3½ | 36x5 | W |
| O. K.....L1 | 2½ | 3250 | 4¼x5½ | 36x4 | 36x8 | W |
| O. K.....M1 | 3½ | 4250 | 4½x6 | 36x5 | 36x5d | W |
| Ogden.....D | ½ | .... | 3¾x5 | 36x3½ | 36x5 | W |
| Ogden.....D | 1½ | .... | 3¾x5 | 36x3½ | 36x5 | W |
| Ogden.....E | 2½ | .... | 4½x5¼ | 36x4 | 36x8 | W |
| Old Hickory...W | 1 | 1775 | 3¾x5 | 36x3½* | 36x4* | W |
| Old Reliable...A | 1½ | 2350 | 4 x5 | 34x4 | 36x6 | W |
| Old Reliable...B | 2½ | 3500 | 4¼x6 | 34x4 | 36x4d | W |
| Old Reliable...C | 3½ | 4250 | 4¼x6 | 36x5 | 36x5d | W |
| Old Reliable...D | 5 | 5250 | 4¾x6 | 36x6 | 40x6d | W |
| Old ReliableKLM | 7 | 6000 | 4¾x6¼ | 36x6 | 40x7d | C |
| Oldsmobile Econ. | 1 | 1095 | 3½x5¼ | 35x5† | 35x5† | I |
| Olympic.....A | 2½ | 3200 | 4¼x5½ | 36x4 | 36x8 | W |
| Oshkosh.....A | 2 | 3250 | 3½x5 | 36x6† | 36x6† | 4 |
| Oshkosh.....AA | 2 | 3100 | 3½x5 | 36x6† | 36x6† | 4 |
| Oshkosh.....B | 2½ | 3850 | 4 x5⅛ | 38x7† | 38x7† | 4 |
| Oshkosh.....BB | 2½ | 4000 | 4 x5⅛ | 38x7† | 38x7† | 4 |
| Overland.....4 | ½ | 450 | 3¾x4 | 30x3½ | 30x3½ | B |
| Packard.....EC | 1½–3 | 3100 | 4½x5½ | 36x4 | 36x7 | W |
| Packard.....EX | 1½–3 | 3100 | 4½x5½ | 36x6† | 40x8† | W |
| Packard.....ED | 2–4½ | 4100 | 4½x5½ | 36x5 | 36x5d | W |
| Packard.....EF | 4–7½ | 4500 | 5 x5½ | 36x6 | 40x6d | W |
| Paige.....52-19 | 1½ | 1950 | 4 x5¼ | 34x3½ | 34x5 | W |
| Paige.....54-20 | 2½ | 2420 | 4¼x5½ | 34x4 | 34x8 | W |
| Paige.....51-13 | 3½ | 3145 | 4½x5½ | 36x5 | 36x5d | W |
| Parker.....C-22 | 1 | 1875 | 3¾x5¼ | 34x5† | 34x5† | W |
| Parker.....G-22 | 2½ | 3200 | 4¼x6 | 34x4 | 36x4d | W |
| Parker.....J-20 | 3½ | 3950 | 4½x6 | 36x5 | 40x5d | W |
| Parker.....M-20 | 5 | 4850 | 5 x6 | 36x6 | 40x6d | W |
| Patriot....Revere | 1 | 1380 | 3¾x5 | 35x5† | 35x5† | W |
| Patriot....Lincoln | 2 | 2050 | 4 5¼ | 34x3½ | 34x5 | W |
| Patriot .Washgt'n | 3 | 2900 | 4½x5½ | 36x4 | 36x7 | W |
| Piedmont....4-30 | 1 | 1200 | 3½x5 | 31x4† | 34x4† | W |
| Pierce-Arrow.... | 2 | 3200 | 4 x5½ | 36x4 | 36x4d | W |
| Pierce-Arrow.... | 3½ | 4350 | 4½x6¾ | 36x5 | 36x5d | W |
| Pierce-Arrow.... | 5 | 4850 | 4½x6¾ | 36x5 | 40x6d | W |
| Pioneer.....59 | 1 | 1550 | 3¾x4¼ | 32x4½† | 32x4½† | W |
| Pittsburgher..... | 1½–2 | 3000 | 3½x5 | 36x4 | 36x6 | .. |
| Pittsburgher..... | 3 | 3800 | 4½x5¼ | 36x5* | 36x8 | W |
| Power.....F | 2 | 3150 | 3¾x5¼ | 36x5 | 36x7 | W |
| Power.....C | 3½ | 4250 | 4¼x5½ | 36x5 | 40x10 | W |
| Premocar...B-143 | 1½ | 2475 | 3½x5 | 36x6† | 36x6† | W |
| Rainier.....R-21 | ¾ | 1990 | 3½x5 | 35x5† | 35x5† | W |
| Rainier.....R-19 | 1 | 2150 | 3½x5 | 34x3½ | 31x4 | W |
| Rainier.....R-16 | 1½ | 2490 | 3¾x5 | 34x3½ | 34x5 | W |
| Rainier.....R-18 | 2 | 2890 | 4½x5¼ | 34x4 | 34x6 | W |
| Rainier.....R-20 | 2½ | 3550 | 4½x5¼ | 34x4 | 34x7 | W |
| Rainier.....R-15 | 3½ | 4400 | 4½x5½ | 36x5 | 36x5d | W |
| Rainier.....R-17 | 5 | 5100 | 4½x6 | 36x6 | 36x6d | W |
| Ranger..TK-22-2 | 1½ | 2450 | 3¾x5 | 36x6† | 38x7† | W |
| Reo.....F | ¾–1¼ | 1245 | 4½x4½ | 34x4½† | 34x4½† | B |
| Reliance.....10A | 1½ | 2400 | 4 x5¼ | 36x3½ | 36x5 | I |
| Reliance.....20B | 2½ | 3100 | 4¼x5½ | 36x4 | 36x4d | I |
| Republic.....75 | ¾ | 1395†† | 3½x5 | 32x4½† | 32x4½† | I |
| Republic.....10 | 1 | 1395 | 3¾x5 | 34x3 | 34x4 | I |
| Republic..10 Exp | 1 | 1695 | 3¾x5 | 35x5† | 34x5† | I |
| Republic.....11X | 1½ | 1795 | 3¾x5 | 34x3½ | 34x6 | I |
| Republic.....19 | 2½ | 2195 | 4½x5¼ | 36x4 | 36x7 | I |
| Republic.....20 | 3½ | 3095 | 4½x5½ | 36x5 | 36x10 | I |
| Rowe.....CW | 1½ | 3000 | 3¾x5 | 36x6† | 36x6† | W |
| Rowe...C.D.W. | 2 | 3300 | 4 x5 | 34x4 | 36x3½d | W |
| Rowe...G.S.W. | 3 | 4150 | 4 x6 | 34x5 | 36x5d | W |
| Rowe...G.P.W. | 5 | 5250 | 3¼x5‡ | 38x7† | 42x9† | W |
| Rowe.....HW | 4 | 4500 | 4½x6 | 36x5 | 36x6d | W |
| Rowe.....F. W. | 5 | 5500 | 4½x6 | 36x6 | 40x6d | W |
| Ruggles.....20 | 1 | 1195 | 3¾x5 | 34x5† | 34x5† | B |
| Ruggles.....40 | 2 | 1795 | 4 x5 | 34x5† | 34x7 | D |
| Sandow.....G | 1 | 2295 | 3¾x5 | 34x3½ | 34x5 | W |
| Sandow.....CG | 1½ | 2590 | 3¾x5 | 34x4 | 34x6 | W |
| Sandow.....J | 2½ | 3275 | 4½x5¼ | 36x4 | 36x7 | W |
| Sandow.....M | 3½ | 4295 | 4½x5½ | 36x5 | 36x5d | W |
| Sandow.....L | 5 | 4975 | 4½x5½ | 36x6 | 40x6d | W |
| Sanford....W-15 | 1½ | ††2150 | 3¾x5 | 36x3½* | 36x5* | .. |
| Sanford.....25 | 2½ | .... | 4½x5¼ | 36x4 | 36x4d | W |
| Sanford.....35 | 3½ | .... | 4½x5½ | 36x5 | 36x5d | W |
| Sanford.....50 | 5 | .... | 4¾x6 | 36x5 | 40x6d | W |
| Schacht...2-Ton | 2 | 3200 | 4¼x5½ | 36x4 | 36x7 | W |
| Schacht...3-Ton | 3 | 3800 | 4¼x5½ | 36x5 | 36x5d | W |
| Schacht...4-Ton | 4 | 4200 | 4½x6 | 36x5 | 40x5d | W |
| Schacht...5-Ton | 5 | 4400 | 4½x6 | 36x5 | 40x6d | W |
| Schacht...7-Ton | 7 | 5050 | 4½x6 | 36x6 | 40x7d | W |
| Schwartz.....A | 1 | 1685 | 3½x5 | 34x4½† | 34x4½† | B |
| Schwartz.....K | 2 | 3000 | 3¾x5¼ | 34x3½ | 34x7 | W |
| Schwartz.....L | 3 | 3600 | 4¼x5½ | 36x4 | 36x8 | W |
| Schwartz.....M | 5 | 4900 | 4½x6 | 36x6 | 40x12 | W |
| Selden.....30 | 1½ | 2250 | 3¾x5 | 34x3½ | 34x5 | W |
| Selden.....31 | 1½–2½ | 3350 | 4½x5¼ | 34x5 | 38x7 | W |
| Selden.....50 | 2½ | 3250 | 4½x5¼ | 36x4 | 36x7 | W |
| Selden.....51 | 2½–3½ | 4350 | 4½x5½ | 36x6† | 40x8† | W |
| Selden.....70 | 3½–5 | 3750 | 4½x5½ | 36x5 | 36x10 | W |
| Selden.....90 | 5–7 | 4950 | 4¾x6 | 36x6 | 40x12 | W |
| Seneca.....M | ½ | 820 | 3¼x4½ | 30x3½† | 30x3½† | B |
| Service.....12 | ¾ | .... | 3½x4½ | 32x4½† | 32x4½† | B |
| Service.....15 | 1¼ | .... | 3¾x5 | 34x4½† | 35x5† | B |
| Service.....21 | 1½ | .... | 3½x5½ | 34x3½ | 34x5 | W |
| Service.....32 | 2 | .... | 4 x5½ | 36x3½ | 36x7 | W |
| Service.....37 | 2 | .... | 4¼x5½ | 35x5† | 38x7† | W |
| Service.....52 | 3 | .... | 4¼x5½ | 36x4 | 36x8 | W |
| Service.....72 | 3½ | .... | 4¼x5½ | 36x5 | 36x5d | W |
| Service.....77 | 4 | .... | 4½x6 | 36x5 | 36x5d | W |
| Service.....102 | 6 | .... | 5½x6 | 36x6 | 40x6d | W |
| Signal.....NF | 1 | $1950 | 3¾x5 | 34x5† | 36x6† | W |
| Signal.....H | 1½ | 2450 | 4¼x5¼ | 34x4 | 36x6 | W |
| Signal.....J | 2½ | 2875 | 4½x5½ | 34x4 | 36x8 | W |
| Signal.....M | 3½ | 3675 | 4½x5½ | 36x5 | 40x5d | W |
| Signal.....R | 5 | 4400 | 4¾x6 | 36x6 | 40x6d | W |
| Southern.....10 | 1 | 2090 | 3¾x5 | 34x3½ | 34x4 | W |
| Southern.....15 | 1½ | 2590 | 3¾x5½ | 36x6† | 34x4 | W |
| Southern.....20 | 2 | 2990 | 4¾x5¼ | 36x6† | 40x8* | W |
| Standard.....1-K | 1½ | 1600 | 3¾x5 | 34x3½* | 34x5* | W |
| Standard.....76 | 2½–3 | 2400 | 4½x5¼ | 36x4* | 36x7* | W |
| Standard.....66 | 3½–5 | 3150 | 4½x5½ | 36x5 | 36x10 | W |
| Standard.....5-K | 5–7 | 4400 | 4¾x6 | 36x6 | 40x12 | W |
| Sterling.....1½ | 1½ | 2885 | 4 x5¾ | 36x3½* | 36x5* | W |
| Sterling.....2 | 2 | 3085 | 4 x5¾ | 36x4* | 36x6* | W |
| Sterling.....2½ | 2½ | 3290 | 4¾x5¾ | 36x4* | 36x4d* | W |
| Sterling.....3½ | 3½ | 4325 | 4½x6¼ | 36x5* | 40x5d* | W |
| Sterling.....5-W | 5 | 4950 | 5 x6¼ | 36x6 | 40x6d | W |
| Sterling.....5-C | 5 | 5500 | 5 x6¼ | 36x6 | 40x6d | C |
| Sterling.....7½ | 7½ | 6000 | 5 x6¼ | 36x6 | 40x7d | C |
| Stewart.....14 | ¾ | 1245 | 3¾x5½ | 32x4½† | 32x4½† | I |
| Stewart.....15 | 1 | 1445 | 3¾x5½ | 35x5† | 35x5† | I |
| Stewart.....9 | 1½ | 1790 | 3¾x5 | 34x3½ | 34x5 | I |
| Stewart.....7 | 2 | 2190 | 4½x5¼ | 34x4 | 34x7 | I |
| Stewart.....7-X | 2½ | 2390 | 4½x5½ | 34x4 | 34x7 | I |
| Stewart.....10 | 3½ | 3190 | 4½x5½ | 36x5 | 36x5d | I |
| Stewart....10-X | 3½ | 3190 | 4½x6 | 36x5 | 36x5d | I |
| Stougaton.....C | ¾ | 1240 | 3½x5 | 34x4½† | 34x4½† | W |
| Stoughton.....A | 1 | 1790 | 3¾x5¼ | 34x5 | 34x5 | W |
| Stoughton.....B | 1½ | 2150 | 3¾x5¼ | 36x3½ | 36x5 | W |
| Stoughton.....D | 2 | 2490 | 4 x5½ | 36x4 | 36x7 | W |
| Stoughton.....F | 3 | 3150 | 4¼x5½ | 36x5d | 36x5d | W |
| Sullivan.....E | 2 | 2800 | 4¼x5½ | 36x4* | 36x7* | W |
| Sullivan.....H | 3½ | 3750 | 4½x6 | 36x5 | 36x5d | W |
| Superior.....D | 1 | 1650 | 3¾x5 | 34x4½† | 34x4 | I |
| Superior.....E | 2 | 2600 | 4¼x5¼ | 36x4 | 36x6 | I |
| Super Truck...50 | 2½ | 3300 | 4 x6 | 36x4 | 36x8 | W |
| Super Truck...70 | 3½ | 4300 | 4¼x6 | 36x5 | 40x5d | W |
| Super Truck..100 | 5 | 5300 | 4¾x6 | 36x5 | 40x12 | W |
| Super Truck..150 | 7½ | 6300 | 5 x6 | 36x6 | 40x7d | W |
| Texan.....A38 | ¾ | 1095 | 3½x5 | 33x4 | 33x4 | I |
| Texan.....TK39 | 1½ | 1550 | 3½x5 | 36x6 | 38x7 | W |
| ThomartSpeedT'k | 1¼ | 1795 | 4 x5¼ | 34x5 | 34x5 | B |
| Tiffin.....GW | 1½ | 2100 | 4¼x5½ | 36x3½ | 36x5 | W |
| Tiffin.....MW | 2½ | 2700 | 4¼x5½ | 36x4 | 36x3½d | W |
| Tiffin.....PW | 3½ | 3600 | 4½x5½ | 36x5 | 40x5d | W |
| Tiffin.....F50 | 5 | 4300 | 4¾x6 | 36x6 | 40x6d | W |
| Tiffin.....F60 | 6 | 4500 | 4¾x6 | 36x6 | 40x12 | W |
| Titan..... | 2 | 2950 | 4x5½ | 34x4* | 36x7 | I |
| Titan..... | 3½ | 3950 | 4¼x5½ | 36x5 | 40x10 | I |
| Titan..... | 5 | 4550 | 4½x6 | 36x5 | 40x6d | I |
| Titan.....6-Ton | 6 | 5150 | 4½x6 | 36x5 | 40x12 | I |
| Tower.....J | 1½ | 2900 | 4¼x5¼ | 35x5 | 38x7 | W |
| Tower.....H | 2½ | 3200 | 4¼x5¼ | 36x4 | 36x7 | W |
| Tower.....G | 3½ | 4100 | 4½x5½ | 36x5 | 36x5d | W |
| Traffic.....C | .... | 1595 | 3¾x5 | 34x3½* | 34x5* | I |
| Traffic..... | 3 | 1895 | 3¾x5 | 36x4 | 36x7 | I |
| Transport.....15 | 1 | 1295 | 3¾x5 | 32x4½† | 32x4½† | B |
| Transport.....25 | 1½ | 1795 | 3¾x5¼ | 34x3½* | 34x4* | I |
| Transport.....35 | 2 | 1885 | 3¾x5 | 36x3½* | 36x6* | I |
| Transport.....55 | 3 | 2385 | 4¼x5¼ | 36x4* | 36x8* | I |
| Transport.....60 | 3½ | 2585 | 4¼x5½ | 36x4* | 36x8* | I |
| Transport.....75 | 5 | 3485 | 4½x6 | 36x5* | 36x12* | I |
| Traylor.....B | 1½ | 2390 | 3¾x5⅛ | 34x3½ | 34x5 | W |
| Traylor.....C | 2–2½ | 2850 | 4 x5½ | 36x4 | 36x7 | W |
| Traylor.....D | 3–3½ | 3300 | 4¼x5½ | 36x4 | 36x8* | W |
| Traylor.....F | 5–6 | 4700 | 4½x6 | 36x6 | 40x6d | W |
| Triangle.....AA | 1 | 1285 | 3¼x5 | 34x4½† | 34x4½† | I |
| Triangle.....A | 1½–2 | 1985 | 3¾x5¼ | 34x3½* | 34x6* | I |
| Triangle.....C | 2–2½ | 2285 | 3¾x5¼ | 36x4* | 36x6* | I |
| Triangle.....B | 2½–3 | 2585 | 4 x5¾ | 36x4* | 36x7* | I |
| Triumph.....G | 1 | 1995 | 3¾x5⅛ | 34x5† | 34x5† | W |
| Triumph.....HC | 1½ | 2550 | 3¾x5¼ | 36x3½ | 36x5 | W |
| Triumph.....HB | 2 | 2900 | 3¾x5¼ | 36x4 | 36x7 | W |
| Twin City...B.W. | 2 | 2750 | 4 x5½ | 36x6 | 40x8 | I |
| Twin City...A.W. | 3½ | 3950 | 4½x6 | 36x5 | 40x5d | W |
| [5]Twin City.....B | 3½ | .... | 5½x6 | 36x6 | 36x6 | I |
| [5]Twin City.....A | 5 | .... | 5½x6 | 36x7 | 36x7 | I |
| Ultimate.....A | 2 | 3150 | 4 x5½ | 36x3½ | 36x6 | W |
| Ultimate.....AJ | 2 | 3200 | 4¼x5½ | 36x3½ | 36x6 | W |
| Ultimate.....AJL | 2 | 3250 | 4¼x5½ | 36x3½ | 36x6 | W |
| Ultimate.....B | 3 | 3700 | 4¼x5½ | 36x4 | 36x4d | W |
| Ultimate.....BL | 3 | 3800 | 4¼x5½ | 36x4 | 36x4d | W |
| Ultimate.....D | 5 | 5500 | 5 x6½ | 36x6 | 40x12 | W |
| Union.....FW | 2½ | 3190 | 4 x6 | 36x5* | 36x8* | D |
| Union.....HW | 4 | 4650 | 4½x6 | 36x6 | 40x12 | D |
| Union.....JW | 6 | 5800 | 5 x6 | 36x6 | 40x14 | D |
| United.....A | 1½ | 2140 | 3¾x5¼ | 36x3½* | 31x5* | W |
| United.....B | 2½ | 3150 | 4¼x5½ | 36x4* | 36x7* | W |
| United.....C | 3½ | 3975 | 4¼x5½ | 36x5 | 36x5d | W |
| United.....V | 5 | 4500 | 4½x6 | 36x6 | 40x6d | W |
| United States...U | 1 | 1875 | 3½x5⅛ | 34x5† | 34x5† | B |
| UnitedStates,NW | 1½ | 2225 | 3¾x5 | 36x5 | 36x3½ | W |
| United States...N | 1½ | 1975 | 3¾x5 | 36x3½* | 36x5* | I |
| United States...R | 3 | 3075 | 4 x5¼ | 36x4 | 36x4d | W |
| United States...S | 4 | 3875 | 4½x5½ | 36x5 | 36x5d | W |
| United States...T | 6 | 4850 | 4¾x6½ | 36x6 | 40x6d | W |
| Velie.....46 | 1½ | 1585 | 3¾x5 | 36x3½ | 36x5 | I |
| Veteran.....M** | 1½ | 2690 | 3¾x5¼ | 35x5† | 35x5† | W |
| Veteran.....P** | 2 | 3609 | 4¼x5½ | 36x4 | 36x7 | W |
| Veteran.....R** | 3 | 4200 | 4¼x5½ | 36x4 | 36x7 | W |
| Veteran.....S** | 4 | 5395 | 4½x6 | 36x5 | 36x10 | W |

*2-cyl †6-cyl. ‡8-cyl. All others, not marked, are 4-cyl. Trac., Tractor. **Canadian made.

Final Drive: W—Worm, I—Internal Gear, C—Chains, D—Double Reduction, B—Bevel, 4—Four-Wheel, E—External Gear. *Tires—optional. †Pneumatic Tires. d—dual. All others solid. ††Price includes body. §—Price includes several items of equipment.

3—Moreland Road Runner. 4—Nelson Le Moon. 5—Twin City Four Wheel Drive.

# Specifications of Current Motor Truck Models—Continued

| NAME AND MODEL | Tons Capacity | Chassis Price | Bore and Stroke | TIRES Front | TIRES Rear | Final Drive |
|---|---|---|---|---|---|---|
| Vim.....29 | ½ | $1050 | 3½x4½ | 31x4† | 31x4† | W |
| Vim.....30 | ½ | 1175 | 3½x4½ | 32x4½ | 32x4½ | W |
| Vim.....31 | 1 | 1975 | 3¾x5½ | 35x5† | 35x5† | W |
| Vim.....22 | 2 | 3150 | 3¾x5½ | 36x4 | 36x6 | W |
| Vim.....23 | 3 | 3950 | 4¼x5½ | 36x5 | 36x5d | W |
| Vulcan.....25 | 2½ | 4000 | 4¼x6 | 36x4 | 36x8 | W |
| Vulcan.....25P | 3 | 4500 | 4¼x6 | 36x6 | 40x8 | W |
| Walker-JohnsonA | 2 | 2500 | 3¾x5 | 34x5 | 38x7 | W |
| Walker-JohnsonB | 3 | 3500 | 4¼x5½ | 36x4 | 36x8 | W |
| Walter.....S | 5 | 4850 | 4½x6½ | 36x6 | 40x6d | W |
| Ward-LaF.....2B | 2½ | 2990 | 4¾x5¼ | 36x4 | 36x4d | W |
| Ward-LaF.....4A | 3½ | 3990 | 4½x6¼ | 36x5 | 36x5d | W |
| Ward-LaF.....5A | 5 | 4590 | 5 x6¼ | 36x6 | 40x6d | W |
| Watson.....B | 1 | 1865 | 3¾x5¼ | 35x5† | 35x5† | W |
| Watson.....N | 3½ | 4250 | 4½x5½ | 36x5 | 36x10 | W |
| Western....W1½ | 1½ | 2550 | 4¼x5¼ | 36x3½* | 36x5* | W |
| Western....L1½ | 1½ | 2550 | 3¾x5 | 36x3½* | 36x5* | W |
| Western....W2½ | 2½ | 3250 | 4½x5¼ | 36x4 | 36x7 | W |
| Western....L2½ | 2½ | 3250 | 4¼x6 | 36x4 | 36x7 | W |
| Western....W3½ | 3½ | 4250 | 4½x6 | 36x5 | 40x5d | W |
| White.....15 | ¾ | $ 2400 | 3¾x5½ | 34x5† | 34x5† | B |
| White.....20 | 2 | 3250 | 3¾x5½ | 36x4* | 36x7 | D |
| White.....40 | 3½ | 4200 | 3¾x5¾ | 36x5 | 40x5d | D |
| White.....45 | 5 | 4500 | 4¼x5¾ | 36x6 | 40x6d | D |
| White Hick.....E | 1 | 1225 | 3¾x5 | 34x5† | 34x5† | W |
| White Hick....H | 1½ | 1375 | 3¾x5 | 36x3½ | 36x5 | W |
| White Hick....K | 2½ | 1675 | 4½x5¼ | 36x4 | 36x5 | W |
| Wichita.....K | 1 | 1875 | 3¾x5¼ | 36x3½ | 36x4* | W |
| Wichita.....M | 2 | 2400 | 3¾x5¼ | 36x3½* | 36x6* | W |
| Wichita.....RX | 3 | 3200 | 4¾x5¼ | 36x4* | 36x8* | W |
| Wichita.....O | 4 | 3500 | 4½x6¼ | 36x5* | 36x5* | W |
| Wilcox.....AA | 1 | 1900 | 3¾x5½ | 36x1* | 36x4* | W |
| Wilcox.....BB | 1½ | 2550 | 4¼x5 | 36x4 | 36x5 | W |
| Wilcox.....D | 2½ | $3000 | 4¼x5 | 36x4* | 36x3½d* | W |
| Wilcox.....E | 3½ | 3950 | 4½x6 | 36x5* | 36x5d* | W |
| Wilcox.....F | 5 | 4350 | 4¾x6½ | 36x5 | 40x6d | W |
| Wilson.....F | 1½ | 2270 | 3¾x5 | 36x3½ | 36x5 | W |
| Wilson.....EA | 2½ | 2825 | 4½x5¼ | 36x4 | 36x7 | W |
| Wilson.....G | 3½ | 3685 | 4½x5½ | 36x5 | 36x5 | W |
| Wilson.....H | 5 | 4520 | 4¾x6 | 36x6 | 40x6 | W |
| Wisconsin.....A | 1 | 1750 | 3¾x5 | 34x5† | 34x5† | W,B |
| Wisconsin.....B | 1½ | 2100 | 3¾x5 | 35x5 | 36x6 | W |
| Wisconsin.....C | 2½ | 2700 | 4 x5¾ | 36x6† | 36x7 | W |
| Wisconsin.....D | 3½ | 3000 | 4¾x5¾ | 36x6† | 40x8 | W |
| Wisconsin.....E | 5 | 3500 | 4½x6¼ | 36x6 | 36x10 | W |
| Wisconsin.....F | 7 | 4000 | 5 x6¼ | 36x6 | 36x12 | W |
| Witt-Will.....N | 1½ | 2250 | 3¾x5 | 36x3½* | 36x5* | W |
| Witt-Will.....P | 2½ | 2750 | 4½x5¼ | 36x3½* | 36x7* | W |
| Wolverine.....J | 1 | 2125 | 3½x5 | 34x3 | 34x4 | I |
| Wolverine.....J | 1½ | 2375 | 3¾x5 | 34x3½ | 34x5 | I |
| Wolverine.....J | 2 | 2640 | 3¾x5 | 34x4 | 34x7 | I |
| Wolverine.....J | 2½ | 3425 | 4½x5¼ | 36x5 | 36x10 | I |
| Wolverine.....L | 3½ | 4100 | 4½x5½ | 36x5 | 36x10 | I |

*2-cyl. †6-cyl. ‡8-cyl. All others, not marked, are 4-cyl. Trac., Tractor. **Canadian made.

Final Drive: W—Worm, I—Internal Gear, C—Chains, D—Double Reduction, B—Bevel, 4—Four-Wheel, E—External Gear. *Tires—optional. †Pneumatic Tires. d—dual. All others solid. ††Price includes body. §—Price includes several items of equipment.

# Specifications of Current Farm Tractor Models

| TRADE NAME | Rating | Price | Wheels or Crawlers | Engine | Cylinders: Bore, Stroke | Fuel | Plow Capacity |
|---|---|---|---|---|---|---|---|
| Allis-Chalm..B | 6-12 | $250 | 2 | LeR. | 4-3½x4½ | Gas. | 1 |
| Allis-Chal.G.P | 15-25 | 1350 | 4 | Midw. | 4-4½x5½ | Gas. | 3 |
| Allis-Chalm... | 20-35 | 1885 | 4 | Own | 4-4¾x6½ | GorK | 3-4 |
| Allis-Chalm... | 20-35 | 2085 | 4 | Own | 4-4¾x6½ | G,K | 4 |
| Allwork...2-G | 14-28 | 1695 | 4 | Own | 4-4¾x6 | GorK | 3 |
| Allwork.....C | 14-28 | 1395 | 4 | Own | 4-5 x6 | GorK | 3 |
| AndrewsKin.D | 18-36 | 2500 | 4 | Clim. | 4-5 x6½ | GorK | 4 |
| ARO..1921-22 | 3-6 | 385 | 4 | Own | 1-4½x5 | Gas. | 1 |
| Aultman-T,... | 15-30 | 2200 | 4 | Clin. | 4-5 x6½ | G,K | 4 |
| Aultman-T,... | 22-45 | 3420 | 4 | Own | 4-5½x8 | G,K | 6 |
| Aultman-T,... | 30-60 | 4500 | 4 | Own | 4-7 x9 | G,K,D | 8-10 |
| Automot. B-3 | 12-24 | 1250 | 4 | Here. | 4-4 x5½ | Gas. | 2-3 |
| Avery,SR.Cul. | 5-10 | .... | 4 | Own | 4-3 x4 | G,K | .. |
| Avery..Cult-C | .... | .... | 3 | Own | 6-3 x4 | G,K | .. |
| Avery.....B | 5-10 | .... | 4 | Own | 4-3 x4 | G,K | 2 |
| Avery.....C | .... | .... | 4 | Own | 6-3 x4 | G,K | .. |
| Avery..... | 8-16 | .... | 4 | Own | 2-5½x6 | G,K,D | 2-3 |
| Avery..... | 12-20 | .... | 4 | Own | 4-4½x6 | G,K,D | 3-4 |
| §Avery..... | .... | .... | * | Own | 4-4x5½ | G,K,D | 3 |
| Avery..... | 12-25 | .... | 4 | Own | 2-6½x7 | G,K,D | 3-4 |
| Avery..... | 14-28 | .... | 4 | Own | 4-4¾ | G,K,D | 3-4 |
| Avery..... | 18-36 | .... | 4 | Own | 4-5½x6 | G,K,D | 4-5 |
| Avery..... | 25-50 | .... | 4 | Own | 4-6½x7 | G,K,D | 5-6 |
| Avery..... | 45-65 | .... | 4 | Own | 4-7¾x8 | G,K,D | 8-10 |
| Bates Mule.H | 15-25 | .... | 4 | Midw | 4-4½x5¼ | Gas. | 3 |
| Bates Mule..F | 18-25 | .... | *2 | Midw | 4-4½x5½ | Gas. | 3 |
| ‡Bates MuleG | 25-35 | .... | *2 | Midw | 4-4½x6 | Gas. | .. |
| Beeman,....G | 2-4 | 240 | 4 | Own | 1-3½x4½ | Gas. | .. |
| Best..... | 18-30 | 3100 | *2 | Own | 4-4¾x6½ | G,K,D | 4 |
| Best..... | 60 | 5450 | *2 | Own | 4-6½x8½ | G,K,D | 8-9 |
| Boring...1921 | .... | 1850 | 3 | Wauk | 4-4¾x5¾ | GorK | 2 |
| Burn-Oil, 1922 | 15-30 | 1435 | 4 | Own | 2-6¾x7 | Ker. | 3-4 |
| Capital..... | 15-30 | 1000 | 2 | Own | 4-4¼x6 | Gas. | 3 |
| Case..... | 10-18 | 700 | 4 | Own | 4-3½x5 | GorK | 2 |
| Case..... | 12-20 | 1950 | 4 | Own | 4-4½x5 | G,K,D | 3 |
| Case..... | 15-27 | 1300 | 4 | Own | 4-4½x6 | GorK | 3-4 |
| Case..... | 22-40 | 2550 | 4 | Own | 4-5½x6¾ | GorK | 4-5 |
| Case....40-72 | 40-72 | 5200 | 4 | Own | 7 x8 | G,K,D | 8-10 |
| Caterpillar .5T | 25 | .... | *2 | Own | 4-4¾x6 | Gas. | 4 |
| Caterpillar 10T | 40 | .... | *2 | Own | 4-6½x7 | Gas. | 6 |
| Caterpillar T35 | 15-25 | .... | 2 | Own | 4-4 x5½ | Gas. | 3 |
| Centaur..... | 5-2½ | 345 | 2 | N Way | 2-4½x4½ | GorK | 1 |
| Chicago....40 | 40 | 2500 | 4 | Own | 4-4½x6 | Gas. | 4 |
| Cletrac.....F | 9-16 | 595 | *2 | Own | 4-3¼x4½ | G,K,D | 2 |
| Cletrac.....W | 12-20 | 1345 | *2 | Own | 4-4 x5½ | G,K,D | 2-3 |
| Dakota.....4 | 15-27 | 1500 | 3 | Dom, | 4-4¾x6 | Gas. | 3 |
| Depue.....A | 20-30 | 2500 | 4 | Buda | 4-4½x6 | Gas. | 4 |
| Dill.....D | 20 | 2380 | 4 | Cont. | 4-4½x5½ | Gas. | 3 |
| Dill.....R.W. | 20 | 2980 | 4 | Midw. | 4-4½x6 | Gas. | 3 |
| De-It-All....A | 3-6 | 495 | .. | Own | 1-4½x5 | Gas. | 1 |
| Eagle.....F | 12-22 | .... | 4 | Own | 2-7 x8 | GorK | 3-4 |
| Eagle.....F | 16-30 | .... | 4 | Own | 2-8 x8 | GorK | 4-5 |
| Eagle.....H | 16-30 | .... | 4 | Own | 2-8 x8 | G or K | .. |
| E-B.....AA | 12-20 | 1095 | 4 | Own | 4-4¾x5 | G,K,D | 3 |
| E-B.....Q | 12-20 | 750 | 4 | Own | 4-4¾x5 | G,K,D | 3 |
| E-B..... | 16-32 | 1750 | 4 | Own | 4-5¼x7 | G,K,D | 4 |
| Fageol.....D | 9-18 | 1525 | 4 | Lyc. | 4-3½x5 | Gas. | 2 |
| Farm Horse.B | 18-30 | 1885 | 4 | Clim. | 4-5 x6½ | G,K | 4 |
| Farquhar.... | 15-25 | .... | 4 | Buda | 4-4½x6 | G,K,D | 3-4 |
| Farquhar..... | 18-35 | .... | 4 | Own | 4-6 x8 | G,K,D | 4-5 |
| Farquhar..... | 25-50 | .... | 4 | Own | 4-7 x8 | G,K,D | 6-7 |
| Fitch..4 Drive | 20-35 | 1850 | 4 | Clim. | 4-5 x6½ | GorK | 3-4 |
| Fordson..... | -18 | 395 | 4 | Own | 4-4x5 | G,K | 2 |
| Fox.....E | 20-40 | 2390 | 4 | Own | 4-5½x7½ | G or K | 4 |
| Franklin....G | 18-30 | 4000 | *2 | Clim. | 4-5 x6½ | G or K | 3-4 |
| Franklin....C | 18-30 | 3350 | *2 | Clim. | 4-5 x6½ | G or K | 3-4 |
| Franklin...G2 | 18-30 | $4350 | 2 | Clim. | 4-5 x6½ | G or K | 3-4 |
| Frick.....A | 12-20 | .... | 4 | Erd. | 4-4 x6 | G,K | 2-3 |
| Frick.....C | 15-28 | .... | 4 | Beav. | 4-4¾x6 | G,K | 3-4 |
| Grain Belt...A | 18-36 | 2150 | 4 | Wauk. | 4-4¾x6¾ | G or K | 4 |
| Gray.....1920 | 18-36 | 2000 | 3 | Wauk | 4-4¾x6¾ | Gas, | 4 |
| Gt. Western St | 20-30 | 1950 | 4 | Beav. | 4-4¾x6 | K | 4 |
| Hart-Parr..20 | 20 | 945 | 4 | Own | 2-5¼x6½ | K,D. | 2 |
| Hart-Parr..30 | 30 | 1295 | 4 | Own | 2-6½x7 | K,D. | 3 |
| ‡Hart-Parr.... | .... | 1695 | 4 | Own | 6½x7 | K.D. | .. |
| Heider.....D | 9-16 | 870 | 4 | Wauk | 4-4¼x5¾ | G,K | 2 |
| Heider.....C | 12-20 | 995 | 4 | Wauk | 4-4½x6¾ | G,K | 3 |
| Heider.....Cult | 5-10 | 800 | 4 | LeR. | 4-3½x4½ | Gas. | 1 |
| Huber Light 4.. | 12-25 | 1185 | 4 | Wauk | 4-4½x5¾ | G or K | 3 |
| Huber Super 4 | 15-30 | 1885 | 4 | Midw. | 4-4½x6 | Gas | 3 |
| Illinois, Super-Drive.....C | 15-30 | .... | 4 | Clim. | 4-5 x6½ | G,K | 4 |
| Imperial... E | 40-70 | 4500 | 4 | Own | 4-7½x9 | G,K,D | 10 |
| Indiana.....F | 5-10 | 665 | 2 | LeR. | 4-3½x4½ | Gas. | 1-2 |
| International.. | 8-16 | †670 | 4 | Own | 4-4¼x5 | G,K,D | 2 |
| Internatl.Titan | 10-20 | †790 | 4 | Own | 2-6½x8 | G,K,D | 3 |
| International.. | 15-30 | 1750 | 4 | Own | 4-5¼x8 | G,K,D | 4 |
| J-T.....N | 20-40 | .... | *2 | Clim. | 4-5x6½ | G,K,D | 3-4 |
| Lauson.....5 | 12-25 | 1495 | 4 | Midw | 4-4½x5¼ | Gas. | 3 |
| Lauson.....20 | 15-25 | 1495 | 4 | Beav. | 4-4½x6 | G or K | 3-4 |
| Lauson.....21 | 15-30 | 1875 | 4 | Beav. | 4-4¾x6 | G or K | 3-4 |
| ‡Lauson Road | 15-30 | 2100 | 4 | Beav. | 4-4¾x6 | K | .... |
| Leader.....B | 12-18 | 685 | 4 | Own | 2-6 x6¼ | G,K,D | 2-3 |
| Leader.....N | 16-32 | 1725 | 4 | Clim. | 4-5 x6½ | G,K | 3-4 |
| ‡Leader...GU | 18-35 | 2150 | *2 | Clim. | 4-5 x6½ | G,K | 3-4 |
| Linn.....H4J | 40- | 4500 | * | Cont. | 4-4½x5½ | Gas | 4 |
| Linn.....W | 60 | 5000 | * | Wauk | 4-5 x6¼ | Gas | 6 |
| Little Giant,.B | 16-22 | 2200 | 4 | Own | 4-4½x5 | K | 4 |
| Little Giant,.A | 26-35 | 3300 | 4 | Own | 4-5½x6 | K | 6 |
| Lombard.1922 | 85-150 | 8950 | *2 | Wisc. | 6-5½x6¾ | Gas. | 16 |
| Lombard.1922 | 50 | 5300 | *2 | Wisc. | 4-4¾x6½ | Gas. | 6-10 |
| Master Jr..... | 5-10 | 585 | | LeR. | -2¾x4 | Gas. | 1 |
| MerryGar1922 | 2 | 210 | 2 | Evin | 1-2½x2½ | Gas. | .. |
| Minne...All-P | 12-25 | 900 | 4 | Own | 4-4½x7 | G or K | 3 |
| Minne. Gen.P | 17-30 | 1675 | 4 | Own | 4-4¾x7 | G or K | 3-4 |
| Minne. Med.Duty | 22-44 | 3000 | 4 | Own | 4-6 x7 | G or K | 5-6 |
| Minne. HeavyDuty | 35-70 | 4150 | 4 | Own | 4-7½x9 | G or K | 8-9 |
| Mohawk .1922 | 8-16 | 650 | 2 | Light | 4-3½x4½ | K or G | 1-2 |
| Moline Univ D | 9-18 | .... | 2 | Own | 4-3½x5 | Gas. | 2-3 |
| Moline Orch.. | 9-18 | .... | 2 | Own | 4-3½x5 | Gas. | 2-3 |
| Motor Macult. | 1½ | 195 | 2 | Own | 1-2¾x3½ | Gas. | .. |
| NB.....1 | 3-6 | 425 | 4 | Own | 2-3¾x4 | Gas. | 1 |
| Nichols-Shep. 20-42. | 20-42 | 2650 | 4 | Own | 8 x10 | G or K | 3-6 |
| Nichols Shep. 25-50 | 25-50 | 3000 | 4 | Own | 9 x12 | G or K | 4-7 |
| Nilson Senior.. | 20-40 | 1975 | 5 | Wauk | 4-5 x6¼ | G,K | 4 |
| Oil Pull.....K | 12-20 | .... | 4 | Own | 2-6 x8 | K,D | 3 |
| Oil Pull.....H | 16-30 | .... | 4 | Own | 2-7 x8½ | K,D | 4 |
| Oil Pull ....G | 20-40 | .... | 4 | Own | 2-8 x10 | K,D | 5-6 |
| Oil Pull.....E | 30-60 | .... | 4 | Own | 2-10x12 | K,D | 8-10 |
| Oldsmar GarK | 2½-5 | 225 | 4 | Own | 1-5½x5½ | Gas. | 1 |
| Oshkosh....M | 6-12 | 650 | 2 | Own | 2-4 x6 | G,K | *1 |
| Oshkosh....G | 12-24 | 985 | 2 | Own | 2-6 x7 | G,K | 3 |
| Peoria.....L | 12-25 | $1600 | 4 | Clim. | 4-5 x6½ | G,K | 3 |
| Pioneer.....G | 18-36 | 1750 | 4 | Own | 4-5½x6 | G,K,D | 4 |
| Pioneer.....C | 40-75 | 3550 | 4 | Own | 4-7 x8 | Gas. | 10 |
| Plowman....A | 15-30 | 1295 | 4 | Buda | 4-4½x6 | G,K | 3-4 |
| Reliable..... | 10-20 | 390 | 4 | Own | 2-6 x7 | Ker. | 2 |
| Rex..... | 12-25 | 1600 | 4 | Wauk | 4-4¼x5¾ | G or K | 3 |
| Russell..... | 12-24 | 1500 | 4 | Own | 4-4¼x5¾ | G or K | 2-3 |
| Russell..... | 15-30 | 2200 | 4 | Own | 4-5 x6½ | G or K | 3-4 |
| Russell..... | 20-35 | 3000 | 4 | Own | 4-5½x7 | G or K | 4-5 |
| Russell..... | 30-60 | 5000 | 4 | Own | 4-8 x10 | G or K | 8-10 |
| Samson....M | .... | 445 | 4 | Own | 4-4 x5½ | G,K | 2 |
| Sandusky,....J | 10-20 | 1250 | 4 | Own | 4-4¼x5½ | G,K,D | 2 |
| Sandusky...E | 15-35 | 1750 | 4 | Own | 4-5 x6½ | G,K,D | 4 |
| Shelby.....D | 15-30 | .... | 4 | Beav. | 4-4¾x6 | G,K | 3 |
| Shelby.....C | 9-18 | .... | 4 | Wauk | 4-3¾x5¼ | G or K | 2 |
| Steady Pull.. | 12-24 | 1485 | 4 | Own | 4-4 x5 | Gas. | 3 |
| Stinson....4E | 18-36 | 1835 | 4 | Beav. | 4-4¾x6 | G,K | 4 |
| Tioga.....3 | 18-32 | .... | 4 | Wisc. | 4-4½x6 | Gas. | 3-4 |
| Topp-Stewart. | 30-45 | .... | 4 | Wauk | 4-4¾x6¾ | Gas. | 3-4 |
| Toro Cultivator | 6 | 750 | 3 | LeR. | 4-3½x4½ | Gas. | 2 |
| Toro Tractor'22 | 6-10 | 495 | 3 | LeR. | 4-3½x4½ | Gas. | 2 |
| Townsend.... | 10-20 | 800 | 2 | Own | 4-6½x7 | Ker. | 2-3 |
| Townsend.... | 15-30 | 1350 | 2 | Own | 4-7 x8 | Ker. | 3-4 |
| Townsend.... | 25-50 | 2500 | 2 | Own | 4-8½x10 | Ker. | 4-8 |
| Traction Motor | 40-50 | .... | 4 | .... | 8-3¼x5 | Gas. | 4-5 |
| Traylor....TB | 6-12 | 500 | 4 | LeR. | 4-3½x4½ | Gas. | 1-2 |
| Trundaar...10 | 25-40 | 3750 | *2 | Wauk | 4-5 x6½ | G or K | 4 |
| Twin City.... | 12-20 | 1200 | 4 | Own | 4-4¼x6 | G,K | 3 |
| Twin City.... | 20-35 | 2950 | 4 | Own | 4-5½x6¾ | G,K | 5 |
| Twin City.... | 40-65 | 4750 | 4 | Own | 4-7¾x9 | G,K | 8 |
| Uncle Sam C20 | 12-20 | 1795 | 4 | Weid. | 4-4 x5½ | G | 2-3 |
| Uncle Sam B19 | 20-30 | 1985 | 4 | Beav. | 4-4¾x6 | G or K | 3-4 |
| Uncle Sam D21 | 20-30 | 1895 | 4 | Beav. | 4-4¾x6 | G or K | 3-4 |
| Utilitor....501 | 2¾-4 | 295 | 4 | Own | 1-3½x4½ | G | 1 |
| Vim.....B | 15-30 | 1190 | 4 | Wauk | 4-4¾x5¾ | G,K | 3 |
| Wallis.....K | 15-25 | †995 | 4 | Own | 4-4¼x5¾ | G,K | 3 |
| Waterloo....N | 12-25 | 675 | 4 | Own | 2-6½x7 | Ker. | 3 |
| Wetmore21-22 | 12-25 | 1185 | 4 | Wauk | 4-4 x5¾ | G,K | 3 |
| Whitney....D | 9-18 | 595 | 4 | Own | 2-5½x6½ | Gas. | 2 |
| Wichita.....T | 15-30 | 2500 | 4 | Beav. | 4-4½x6 | G,K,D | 3-4 |
| Wisconsin...E | 16-30 | 1850 | 4 | Clim. | 4-5 x6½ | G or K | 3 |
| Wisconsin...F | 20-40 | 2050 | 4 | Wauk | 4-5 x6½ | G or K | 4 |
| Wisconsin,..H | 22-40 | 2550 | 4 | Clim. | 4-5½x7 | G or K | 4-6 |
| Yuba....12-20 | 12-20 | 2400 | *2 | Wisc. | 4-4½x6¾ | G,K,D | 3 |
| Yuba....15-25 | 15-25 | 2750 | *2 | Wisc. | 4-4¼x6 | G,K,D | .. |
| Yuba....23-35 | 20-35 | 3900 | *2 | Wisc. | 4-5¾x7 | G,K,D | 4 |
| Yuba....25-40 | 25-40 | 4250 | *2 | Wisc. | 4-5¾x7 | G,K,D | .. |
| ‡Yuba..... | 25-40 | 4750 | *2 | Yuba | 4-5½x7 | D | .. |
| Zelle..... | 12-25 | .... | 4 | Buda | 4-4¼x5½ | G or K | 3 |

ABBREVIATIONS: G—Gasoline. K—Kerosene. D—Distillate. Plow capacity varies in relation to operating conditions. Figures are based on 14 in. plows. Engine Make: Beav.—Beaver. Clim.—Climax. Cont.—Continental. Dom.—Domas. Evin.—Evinrude. Here.—Hercules. LeR.—LeRoy. Midw.—Midwest. Nway.—New Way. Nor.—Northway. T.C.—Twin City. Wauk.—Waukesha. Weid.—Weidely. Wis.—Wisconsin. *—Crawler type. All others are wheel type. †Price includes plows. §Track Runner. ‡Industrial Tractor.